BY DR. OWEN GEIGER

The Best of the Natural Building Blog

Thriving Sustainably with Earthbag Building and Other Practical Solutions

Our Mission: The Natural Building Blog is committed to providing free information that will improve people's lives in a sustainable and affordable manner. This includes architecture, homesteading, gardening, appropriate technology, renewable energy, Permaculture principles, and ecological living.

Foreword

This free ebook covers the best, most popular articles from the Natural Building Blog. Our blog now has nearly 2,800 blog posts, which is great, however the best stories tend to get 'buried' or hard to find in thousands of pages of content. As you will see below, compiling all this great material into one free online document makes this PDF a highly readable, accessible and indispensable resource for natural builders.

The content in this PDF has been organized by the following categories: Introduction -- important general information such as defining what natural building is, costs of construction, building code issues, and a tour of exemplary natural homes. The next category is Earthbag Building, which is the core focus of our blog because of its low cost, sustainability, and proven hurricane and earthquake resistance. The following category is Strawbale Building, which is now in the building code and extremely popular for its ease and speed of building, and incredibly good insulation value. Next up is Other Building Methods, which covers a range of other practical natural building methods. The Miscellaneous category contains various articles on building details such as passive cooling strategies and small wood stoves. The House Plans category covers many popular small natural house plans that are available for sale. And finally, the Reference category lists some of the best sites where you can find more information on natural building.
Please leave comments and suggestions about this PDF on our blog to help us make more similar ebooks in the future. Enjoy!

Owen Geiger

Introduction to Natural Building

Green Homes

The reason for building greener homes is really quite important. We need to live more lightly on the earth, because the degradation of our environment is compromising not only our survival, but the survival of most other living beings on the planet. We can no longer ignore the impact we have on the earth's ecosystems. The way we live, the choices we make in providing for our needs, will have an enormous influence on the quality of life of those who will follow us. Now is the time to take responsibility for the consequences of our life styles!

How we build our homes, both in design and choice of materials, is one of the most significant ways that we can affect our future. Much of the concern boils down to the use of energy. How much energy is embodied in the building materials themselves, in their transportation and assembling? Then once the house is built, how much energy does it consume to keep its inhabitants comfortable? Consumption of energy has a direct influence on environmental quality, because of the inherent pollution through greenhouse gasses and other emissions. Then there is the loss of natural beauty, ecosystems and basic resources associated with the extraction of fossil fuels and building materials. The combined effect of this is staggering.

GreenHomeBuilding.com http://greenhomebuilding.com

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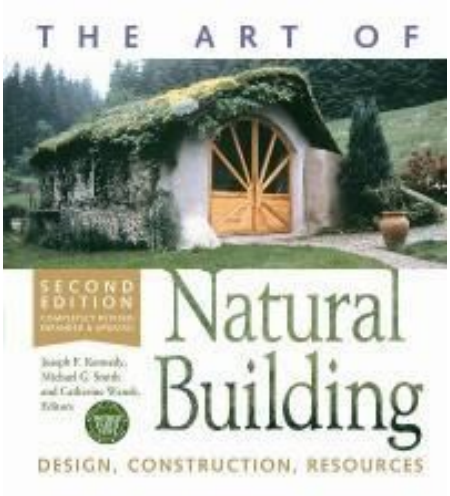
The Art of Natural Building – Second Edition



Completely Revised, Expanded and Updated
Design, Construction, Resources — edited by Joseph F. Kennedy, Michael G. Smith & Catherine Wanek

"The popularity of natural building has grown by leaps and bounds, spurred by a grassroots desire for housing that is healthy, affordable and environmentally responsible. While there are many books available on specific methods such as strawbale construction, cob or timber framing, few other resources introduce the reader to the entire scope of this burgeoning field.

Fully revised and updated, The Art of Natural Building is the complete and user-friendly introduction to natural building for everyone from do-it-yourselfers to architects and designers. This collection of articles from 60 leaders in the field is stunningly illustrated with over 400 photos of natural buildings from around the world. At 465 pages, this massive resource is over 50% longer than the original edition. Out of 64 chapters, 26 are new to this edition, and nearly all the rest have been completely revised to reflect recent developments.

Clearly written, logically organized and beautifully illustrated The Art of Natural Building is the encyclopedia of natural building."

*This is by far the best book available on natural building. The first version was excellent. This one is way better. This book should be required reading for every serious architecture student. Disclaimer: One of my articles is in the book (Small Diameter Roundwood); however, I didn't get paid for it. I just got my copy today and can't say enough good things about the book. Even those who've been studying natural building for years will learn lots of new things. It's not just a bunch of fluff. It's chock full of important details. My review rating is 5 Stars.

http://www.naturalbuildingblog.com/the-art-of-natural-building-second-edition

Low Impact Living

David Omick: Living outside the box

Low impact living is at the heart of what I've been doing for years. It's what drives me and the content of my blogs, articles, books and house plans. Low impact living encompasses much more than just housing, although dirt cheap DIY housing paid with cash is a big part of the solution. Low impact living is intertwined with almost everything we do. I really hope readers will take a few hours or, better yet, a few days reading through the following sites to get a good understanding of low impact living and then put these ideas into regular use.

Kevin and Donna Philippe Johnson, **Earth Star Primal Habitat**
David Omick, **Living Outside the Box** (be sure to check out their Shelter page)
Tyra and James Arraj: **The Treasures of Simple Living**
Dan Price, **Moonlight Chronicles**
A Low Impact Woodland Home
Tony Wrench and Jane Faith, **That Roundhouse**
Dwelling Portably
Path to Freedom Urban Homestead
Tiny House Design
Small House Society
Laurie Baker
The Year of Mud: Cob and Natural Building
No Impact Man
No Money Man
Homesteading Under $3,000
Mobile Kodgers

http://www.naturalbuildingblog.com/low-impact-living/

The Shift Toward Organic Architecture

Simon Dale's Low Impact Woodland Home

Thumb through popular architecture sources and you'll readily spot a growing trend toward curved and round designs. It's a revolt against the box. Oh sure, the status quo suburban box is alive and well, and will likely endure as long as the existing building codes, insurance and financial institutions remain in place. But there's a definite backlash against the packaged homogeneity thrust upon us by marketers, and no doubt fueled by the ongoing economic crisis that's forcing people to explore more affordable options. In addition, more and more people are concerned about the environment and health aspects. People are eager to use recycled items, buy local and use materials that don't offgas toxic chemicals. I say this trend is long overdue.

Try this fun little experiment. Go to Google Images and search for "hobbit houses". Simone Dale's and Tony Wrench's houses will pop up in the search results. Click on a few of these images until you find some of their photos on blogs. Almost without fail people leave comments like "Absolutely love it. Wish I could live in a house like this". Now keep in mind that these houses and other similar ones are probably on hundreds of blogs and then you start to realize the full impact. It really gets you thinking. This is what many people want – low cost, simple to build, organic – but the current system severely limits the options. Marketers are fighting basic human instinct. After all, humans built their own homes throughout most of history, and of course, they built them to suit their individual needs. Only recently have mega corporations rolled out their version of how we should live, and we can see how swimmingly that has gone. Underwater, bankrupt, foreclosed… It's way, way, way past time to turn the sinking ship around.

Note: I believe a home like this can be built faster and more durable with earthbags.

http://www.naturalbuildingblog.com/the-shift-toward-organic-architecture/

Preferred Building Materials for the Rich?

Luxury stone home

What building materials do the rich typically use to build their homes? And likewise, what materials would you choose if you had nearly unlimited financial resources? Wood paneling or sheet rock? Granite and marble counters or plastic laminate? Wood, tile and stone floors or vinyl? Berber wool rugs or synthetic? Wood shakes, tile, slate and copper or asphalt shingles? Timber frame or stud frame? Thick walls or thin? Just look around a bit and you'll see the answers are obvious. Most people prefer the beauty of natural materials when they can afford them. (Note: I could have located multi-million dollar adobe and rammed earth houses, but I just grabbed a few samples from one website.)

So here's the good news for the rest of us: Build your own home using low cost building methods such as earthbag, building in stages if necessary and paying as you go, and you can surround yourself with the beauty of natural materials. You don't have to be rich.

The homes shown here are from Aspen, Colorado – one of most expensive real estate markets in the U.S.

http://www.naturalbuildingblog.com/preferred-building-materials-for-the-rich

Earth-sheltered Homes

- Earth-sheltered home

"Earth sheltering is the architectural practice of using earth against building walls for external thermal mass, to reduce heat loss, and to easily maintain a steady indoor air temperature. Earth sheltering is popular in modern times among advocates of passive solar and sustainable architecture, but has been around for nearly as long as humans have been constructing their own shelter.

The expression earth-sheltering is a generic term, with the general meaning: building design in which soil plays an integral part.

Definition of earth-sheltering: A building can be described as earth-sheltered if its external envelope is in contact with a thermally significant volume of soil or substrate (where "thermally significant" means making a functional contribution to the thermal effectiveness of the building in question.)

There may be said to be three forms of earth-sheltered building:
– earth-covered
– earth-bunded [I call this earth bermed.]
– subterranean

The benefits of earth sheltering are numerous. They include: taking advantage of the earth as a thermal mass, offering extra protection from the natural elements, energy savings, providing substantial privacy, efficient use of land in urban settings, shelters have low maintenance requirements, and earth sheltering commonly takes advantage of passive solar building design.

The Earth's mass absorbs and retains heat. Over time, this heat is released to surrounding areas, such as an earth shelter. Because of the high density of the earth, change in the earth's temperature occurs slowly. This is known as 'thermal lag.' Because of this principle,

the earth provides a fairly constant temperature for the underground shelters, even when the outdoor temperature undergoes great fluctuation. In most of the United States, the average temperature of the earth once below the frost line is between 55 and 57 degrees Fahrenheit (13 to 14 degrees Celsius). Frost line depths vary from region to region. In the USA frost lines can range from roughly 20 inches to more than 40 inches. Thus, at the base of a deep earth berm, the house is heated against an exterior temperature gradient of perhaps ten to fifteen degrees, instead of against a steeper temperature grade where air is on the outside of the wall instead of earth. During the summer, the temperature gradient helps to cool the house.

The reduction of air infiltration within an earth shelter can be highly profitable. Because three walls of the structure are mainly surrounded by earth, very little surface area is exposed to the outside air. This alleviates the problem of warm air escaping the house through gaps around windows and door. Furthermore, the earth walls protect against cold winter winds which might otherwise penetrate these gaps."

From by Rob Roy:
"Back in the '70s, earth-sheltered housing enjoyed great popularity, thanks in part to the energy crisis resulting from the 1973 oil embargo. Adventurous builders and researchers explored various forms of earth-sheltered building, from underground excavated spaces to surface-level buildings with earth piled in berms against their walls. People searching for alternatives to conventional building showed that sheltering a building with earth could reduce energy costs for both heating and cooling by half or more — at little or no increased expense… An earth-bermed house can reap about 95 percent of the energy advantages of a fully underground home, and adding an earth roof, or living roof, further promotes planetary health by "greening" the house's footprint."

http://www.naturalbuildingblog.com/earth-sheltered-homes

Ted Owens, author/publisher Building With Awareness – The Construction of a Hybrid Home

A growing number of people are disillusioned with conventional housing made of 2x4s and sheetrock (the way most homes in North America are built). These homes are filled with materials such as particleboard, plywood, plastic, linoleum, and synthetic carpet and paint that contain known carcinogens and allergens. These man-made materials offgas toxic chemicals such as formaldehyde, and often continue to do so for many years. Occupants of these homes frequently acquire 'sick house syndrome' from breathing these noxious fumes.

But many are beginning to see through the charade. Why work a lifetime for an impersonal, mass-produced commodity that endangers lives and the environment, and does not reflect their ethos?

Natural building solves all of these problems by utilizing locally available, low-impact building materials such as straw, stone, earth, bamboo, small diameter wood and recycled materials. Natural building requires more labor, but has many advantages such as being lower cost, more beautiful and environmentally friendly. Natural materials also are owner-builder friendly, because they typically require only basic skills and a few simple tools. In our high-tech, high-stress era, many find solace and personal satisfaction in working with their hands to build their dream home with natural materials.

Although the building methods and materials described in this article are well documented in thousands of websites and hundreds of books, magazines and videos, many people are still unaware of them. The best way to learn about natural building may be to see finished homes and hear them described by their builders. Thanks to the power of the Internet, these homes are now just a click away.

Without further ado, let's take the natural building tour:
– **Ted Owens' strawbale solar home** in Corrales, New Mexico: Author/publisher Building

With Awareness – The Construction of a Hybrid Home, recipient of three Telly Awards for excellence, Ted Owens masterfully blends straw bales and adobes in this southwestern style home.
– Robert Laporte and Paula Baker-Laporte, owners **EcoNest Design and EcoNest Building**, Tesuque, New Mexico: Authors of EcoNest, Creating Sustainable Sanctuaries of Clay, Straw, and Timber, their homes feature timber framing, clay/straw walls, earth plastering and natural, non-toxic finishes.
– **Deanne Bednar's strawbale studio**, Oxford, Michigan: Using timeless design principles of curved walls, exposed timbers and stone foundations, this home is a classic example of the beauty of natural materials.
– **Alison Kennedy's earthbag home** in Moab, Utah: Many earthbag homes are domes, but this house demonstrates earthbags are equally suitable for structures with vertical walls.
– **Ben Law**, roundwood timber frame house, author The Woodland House and other books, West Sussex, UK: One of the most sustainably built houses on the planet, this home is built with bowed timbers (rejected by sawmills because they're not straight) and coppiced wood. There is no photo gallery on this site, but you can see samples of his work.
– **The Canelo Project**, Bill and Athena Steen, Elgin, Arizona: Authors of numerous books on natural building, Bill and Athena are leaders in their field at combining simple materials such as straw and earth into exquisite, tasteful simple dwellings.
– **OM Dome**, Koh Phangan, Thailand: Master builder Trevor Lytle oversaw the construction of the world's largest earthbag dome (27 foot diameter), a spiritual temple for the Pyramid Yoga Center.

http://www.naturalbuildingblog.com/natural-building-tour-of-eco-friendly-affordable-homes-2/

The £150 ($250) Hobbit House

Michael Buck built this house at the bottom of his garden for just £150 using natural or unwanted materials he found in skips (dumpsters).

"It looks like something straight out of Middle Earth – and the story behind it is almost as fantastical. This cottage cost just £150 to build, using only natural or reclaimed materials, and is now rented out for a fee of fresh milk and cream. And with no mains electricity, gas or water, the bills don't come to much either.

Smallholder Michael Buck spent eight months constructing the house using the ancient technique of cob – building with a mixture of sand, clay, straw, water and earth. He taught himself the method by reading a book, even shaping the walls without a single power tool.

He also made the simple wooden roof frame and thatched it himself with straw from his fields. The 300 sq ft of floor space features floorboards rescued from a skip, while an old windscreen from a lorry provided glass for the windows. With no central heating, you might think it would be a bit chilly, but he says the cob walls and thatched roof make it incredibly well insulated – and the ceiling is stuffed with sheep's wool from a nearby farm to help keep the heat in further."

http://www.naturalbuildingblog.com/the-150-hobbit-hole

The Woodland Home by Simon Dale

A Low Impact Woodland Home by Simon Dale

"You are looking at pictures of a house I built for our family in Wales. It was built by myself and my father in law with help from passers by and visiting friends. 4 months after starting we were moved in and cosy. I estimate 1000-1500 man hours and £3000 put in to this point. Not really so much in house buying terms (roughly £60/sq m excluding labour).

The house was built with maximum regard for the environment and by reciprocation gives us a unique opportunity to live close to nature. Being your own (have a go) architect is a lot of fun and allows you to create and enjoy something which is part of yourself and the land rather than, at worst, a mass produced box designed for maximum profit and convenience of the construction industry. Building from natural materials does away with producers profits and the cocktail of carcinogenic poisons that fill most modern buildings."

http://www.naturalbuildingblog.com/the-woodland-home-by-simon-dale

Ben Law's Woodland Home

Ben Law's woodland home constructed with local materials and straw bale walls.

"Ben Law lives and works at Prickly Nut Woods in West Sussex, UK, where apart from making a living from coppicing he trains apprentices and runs courses on sustainable woodland management, eco-building and permaculture design. He runs a specialist eco-building company The Roundwood Timber Framing Company Limited. This specializes in the supply of roundwood construction timber and a building and project management service.

Ben Law is the author of and , which charts the building of his unique cruck framed home in the woods. The building of his house was filmed for Channel 4's Grand Designs program and was voted the most popular Grand Design ever by viewers. He has also written , a month by month journey through the woodland, a celebration of every aspect of sustainable woodland management, including crafts, seasonal recipes and the rhythm of work throughout the year. Ben's latest book is , a full colour guide to his building techniques which he has also described in a comprehensive training DVD by the same name. He runs occasional open days and courses in response to popular demand."

http://www.naturalbuildingblog.com/ben-laws-woodland-home

Cody Lundin's Zero Energy Home

Cody Lundin's energy efficient, sustainable home

No heating or air conditioning, and yet Cody's house stays around 72 degrees Fahrenheit. Cody's website and book explain how he built his ferrocement house. You could build a house like this with earthbags on the sides and ferrocement on the roof.

"It's winter in the high desert as I write this, and last night the thermometer outside read 9 degrees F (minus 13 degrees C), a bit colder than typical and, ironically, part of the same storm system that left 500,000 people without power in the Midwest. Regardless of single-digit temperatures, my home remained a cozy 72 degrees F (22 degrees C), and it did so without using any conventional energy resources. I have no heating bills of any kind and I don't burn wood. My home is heated entirely by the free clean energy of the sun, a phenomenon commonly referred to as "passive solar." Along with orienting my home solar south, I have the proper square footage of windows to match the square footage of my home so that it doesn't under- or overheat. These windows let in shortwave radiation from the sun that soaks into my stone floor during the day. At night when outside temperatures dip, the stone floor, which is a great conductor of the sun's energy, re-radiates the stored sunshine, or heat, as long-wave radiation that keeps the house warm. Insulation and thermal mass help retain the heat throughout the night. The process starts anew the next day. Even though my home is dependent on the sun for heat, it's designed to retain this comfort for several days of cloudy weather or storms."
http://www.naturalbuildingblog.com/cody-lundins-zero-energy-home

How to Build Dirt Cheap Houses Instructable

Adobe house in Thailand

Ever wonder how to build a simple home for very little money, without going into debt? The key is to use low-cost, locally available natural materials such earth, small diameter wood and straw to keep expenses to a minimum. The real fun is incorporating all of these methods into an optimum, comfortable, affordable home.

Our earthbag projects have confirmed what I've known for a long time – that building at $10/sq.ft. (materials only) or thereabouts is possible. Other aspects of earthbag building — strength, durability, sustainability, etc. — are all important. But perhaps the most important point is affordability, because building at $10/sq. ft. makes housing affordable to virtually everyone on the planet. The last page of this Instructable includes a list of $10/sq. ft. projects built by others.

A big reason for the growing popularity of earthbag building is its low cost. You can build shelters for under $1,000. For $1,000-$5,000 you could have a nice, small home that would outlast most conventional wood-framed houses, and be quieter, non-toxic and more comfortable.

Are you on an extremely tight budget? (Ha, who isn't nowadays.) Then I suggest building small using local natural materials, building in stages and adding on as you can afford it. For instance, build one roundhouse and live in it until you've saved enough to build another. You could join the roundhouses with arched or gabled covered walkways, vine covered pergolas, enclosed passageways or additions, or just leave them free standing. Extending rectilinear structures (adding one room at a time) would be even easier. Building

a little at a time like this requires planning ahead for future doorways and other considerations, but it enables you to build debt free.

Natural building – using locally available, minimally processed natural materials – is the logical solution. There is simply no other way to create affordable housing for all those in need.

http://www.naturalbuildingblog.com/instructable-how-to-build-dirt-cheap-houses

Estimating Costs

It's not difficult estimating costs for small houses. Simply add up the number of each main component and multiply times a realistic cost. Then add about 5%-10% extra to cover unforeseen expenses. Use current, local prices for most accurate results.

You can also do a per square foot cost estimate. This method is not as accurate as a detailed cost breakdown, but does provide a rough estimate.

Here's one example using dirt cheap building techniques. $10/sq. foot is about as low as you can get using simple, low cost materials and methods (earthbags, rubble trench, earth plaster, locally harvested wood, recycled materials, etc.). So a house of about 300 square feet would cost around $3,000 not including land or labor. (300 x $10 = $3,000) Then add any extras you may want: radiant heat, better windows, tile counters, etc. to get a more accurate cost. The cost will be significantly higher if building in areas where you have to meet building codes. Seek out remote, rural areas with few or no building codes to minimize costs.

http://www.naturalbuildingblog.com/estimating-costs

Counties with Few or No Building Codes

Many readers are looking for inexpensive land where they can build their earthbag home. Unfortunately, building codes are often overly restrictive and make it difficult to build with alternative materials such as earthbags, straw bales, etc. But the good news is some counties have very few code barriers. As explained in previous posts, these counties are typically in remote, rural areas.

While responding to a reader's inquiry about this subject, I realized it wouldn't be very difficult to locate these lenient areas if several volunteers worked together. One possibility is for each person to take one state, contact the regional building authority in each county and then compile a list of counties with few or no building codes.

I'm guessing each state could be canvassed in about eight hours or less by using the Internet to locate the phone numbers. This is made easy because most counties now have their own websites. You could probably ignore highly developed counties to save time. Some counties post their building codes and related information on their websites, although it may be faster to call each county building department and ask a few questions about their policies on alternative building: What building code do they use? Do they require a building permit? What are their policies on building with straw bales, earthbags and other

similar materials? Do you need special approval (engineer's stamp) to build with alternative building materials? What's the minimum house size allowed by code?

Once you locate one county that's open to alternative building you might ask them if they know of other counties with similar policies. I would also do some background research. For instance, you may find a site like **Sustainable Building Codes Blog** by Tom Meyers. Mr. Meyers posts about this very issue and offers lots of good advice. One post says "Our current area of preference lies in the heart of Delta County, Colorado. This is one of 11 or so counties in the state with no adopted building code." There you go! Send him an email and maybe he will tell you which counties in Colorado are code-free.

Out of curiosity I searched the **Delta County website**, clicked on Departments, then Planning and Community Development, then **Building Information**. Sure enough, it clearly states "No building permit is required for the construction and placement of any structures in the unincorporated area of Delta County."

http://www.naturalbuildingblog.com/counties-with-few-or-no-building-code

Three Ways Building Codes Escalate Construction Costs

Do you think building codes are fair and set up primarily for society's protection? Guess again. In reality, building codes were written by the timber, steel, brick and concrete industries, in collaboration with banks and insurance companies to maximize profits for themselves. This creates barriers to entry that make it difficult to build with alternative materials.

Here's a true story about a friend's house in Colorado. Dean built his house in the 1960's when building codes were less strict than they are today. At that time he was able to build a modern, very nice looking 2,000 sq. ft. home on a shoestring budget by building with wood from a local sawmill. I can't remember the cost – it's been years since he told me the story, and he's sadly passed on – but the cost was shockingly low (somewhere around a few thousand dollars for a truckload of rough sawn lumber), because the wood was direct from a local mill. Dean told me the story with a big smile in about 1999 while we worked on renovating his home. The Douglas fir studs were so hard that it was almost impossible to drive nails. Everything had to be pre-drilled. The wood was far superior to the poor quality lumber now being sold in building supply centers. Thirty some years later the house was still in excellent condition, and yet Dean pointed out how you can no longer build this way. The sawmill went broke when building codes started requiring lumber must come from certified and inspected mills. That gave a financial edge to giant Weyerhaeuser type companies, and consequently many small companies got wiped out. So what's the situation now? Just look at the crap lumber that 'meets code'. If it's not already twisted and bowed like a banana, it probably soon will be (except for the high grade lumber that's usually set aside for big construction firms).

Example #2:
Building methods such as adobe, rammed earth, earthbag and other simple methods can end up costing more than energy intensive, mass produced materials due to building codes. For instance, a simple cabin could cost $100,000 when you're finished meeting code. Note that **adobe and rammed earth construction** go back many thousands of years, and earthen construction has been shown to easily outlast most modern building materials. But

since the codes are skewed to favor modern materials, most homebuilders choose stick frame construction with sheetrock and pressed board siding even though the end product is far inferior.

Example #3:
Still think the codes are fair and reasonable? Keep reading. The more you dig into this the more dirt you'll find. The latest trend is **Nuisance Abatement Teams** that penalize homeowners for any minor infraction they come up with. I've explained this process in **Building Codes are a Slippery Slope**. ("Give someone an inch and they'll take a mile.") Things don't have to be this way, but that's the direction we're headed. When powerful interests inhibit the freedom for people to build their own home affordably, then I'll call it like I see it.

http://www.naturalbuildingblog.com/three-ways-building-codes-escalate-construction-costs

Eco ‘Hobbit Home’ in Pembrokeshire Faces Demolition

The home has walls of straw and a roof of grass but no planning permission

“A hobbit-style eco-home is threatened with demolition after it was built in open countryside without planning permission.

Charlie Hague and Megan Williams, both 25, have been told to take down the roundhouse in Glandwr near Crymych.

Branches and other natural materials have been used to construct the dwelling

The eco-home has walls made from straw bales, a grass roof and has branches as its frame.”

A Pembrokeshire council enforcement notice states the house was "harmful to the rural character of the locality".

http://www.naturalbuildingblog.com/eco-hobbit-home-in-pembrokeshire-faces-demolition

Living Tiny Legally: Part 1

This video documents a groundbreaking moment in tiny house/natural building history by showing how tiny houses and tiny house communities can be legally built within US cities. Please 'like' and share this video with your friends.

"Living Tiny Legally is a 3 part educational docu-series. It provides an in-depth, inside look into how a handful of cities from all over the country are making legal tiny housing a reality.

An Educational Resource for Tiny House Advocates and City Officials

Part 1: Groundbreaking Progress + Model Tiny House Zoning
An in-depth look at how communities, including Fresno and Ojai (CA), and Rockledge (FL) are turning tiny via innovative zoning. Policy makers share their methods and insights to demystify the planning & zoning process. Advocates provide a better understanding of the tiny house movement and benefits tiny homes could bring your community."

I want to express my heartfelt thanks to everyone who helped produce this excellent landmark documentary. As explained in the video, the template for doing this is now worked out and this could spread very quickly in many other cities. (Things are always difficult the first time around, but it's easy to copy others.) It's refreshing to see some city planners and administrators who are willing to deal with the overwhelming need of affordable housing and actually produce workable solutions. Let's hope this movement spreads to include more alternative/sustainable building ideas. As reported earlier, there were over 40,000 attendees at last year's Tiny House Jamboree in Colorado Springs and

roughly 50,000 people attended the 2016 event. That's in just one medium sized city. Imagine the level of interest across the country. That clearly shows a groundswell of interest in tiny houses. And, of course, as more communities legalize tiny houses then the interest could skyrocket. Think of all the people who can't afford or don't want to buy a big house. Think of all the seniors who want to downsize and all those who want to live more simply. It's a huge market.

Earthbag Building

Earthbag Building.com

Building with earthbags (sometimes called sandbags) is both old and new. Sandbags have long been used, particularly by the military, for creating strong, protective barriers, or for flood control. The same reasons that make them useful for these applications carry over to creating housing. Since the walls are so substantial, they resist all kinds of severe weather (or even bullets) and also stand up to natural calamities such as earthquakes and floods. They can be erected simply and quickly with readily available components, for very little money.

Earthbag building fills a unique niche in the quest for sustainable architecture. The bags can be filled with local, natural materials, which lowers the embodied energy commonly associated with the manufacture and transportation of building materials. The fill material is generally of mineral composition and is not subject to decomposition (even when damp), attractive to vermin, or burnable...in other word it is extremely durable. The fill material is generally completely non-toxic and will not offgas noxious fumes into the building.

Earthbags have the tremendous advantage of providing either thermal mass or insulation, depending on what the bags are filled with. When filled with soil they provide thermal mass, but when filled with lighter weight materials, such as crushed volcanic stone, perlite, vermiculite, or rice hulls, they provide insulation. The bags can even act as natural non-wicking, somewhat insulated foundations when they are filled with gravel.

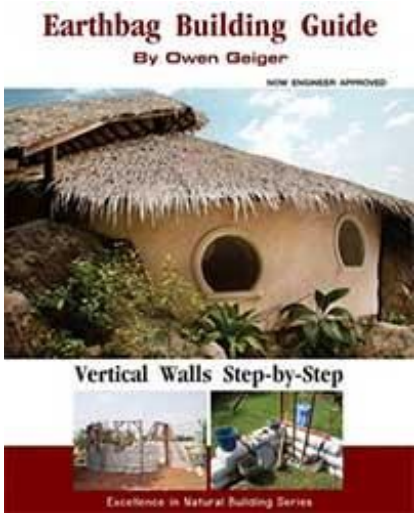
Because the earthbags can be stacked in a wide variety of shapes, including domes, they have the potential to virtually eliminate the need for common tensile materials in the structure, especially the wood and steel often used for roofs. This not only saves more energy (and pollution), but also helps save our forests, which are increasingly necessary for sequestering carbon.

Another aspect of sustainability is found in the economy of this method. The fill material can be literally "dirt cheap," especially if on-site soil is used. The earthbags themselves can often be purchased as misprints or recycled grain sacks, but even when new are not particularly expensive. Burlap bags were traditionally used for this purpose, and they work fine but are subject to rot. Polypropylene bags have superior strength and durability, as long as they are kept away from too much sunlight. For permanent housing the bags should be covered with some kind of plaster for protection, but this plaster can also be earthen and not particularly costly.

The ease and simplicity of building with earthbags should also be mentioned, since there is much unskilled labor available around the world that can be tapped for using this technology. One person familiar with the basics of earthbag building can easily train others to assist in the erection of a building. This not only makes the process more affordable, but also more feasible in remote areas where many common building skills are not to be found.

Note: Earthbag Building.com is our main website where everything related to earthbag building is found. All the best books, videos, articles are located there as well as lists of suppliers and other resources.

Owen's Earthbag Book and DVD



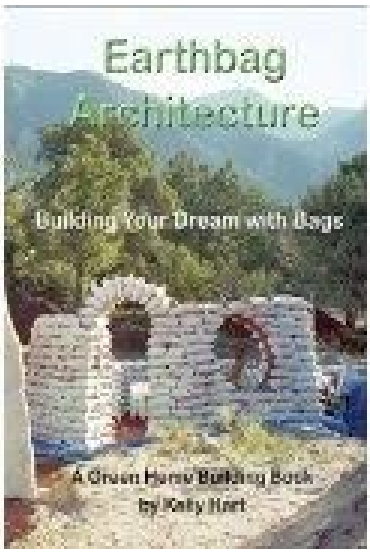
Owen Geiger's **Earthbag Building Guide** is a $20 ebook that you can download immediately after purchasing it, which makes it easily available anywhere in the world. Chapter titles give you a good idea of what it covers: Dirt Cheap Shelter, Choosing a Plan, Tools, Supplies, Foundations, Bag Walls, Tube Walls, Openings and Details, Lintels and Bond Beams, Insulated Walls, Roofs, Plaster, Finishing Details, and First Projects. See the complete table of contents just a little further down on this page.

Much has been learned about earthbag building over the last few decades through research, trial and error, and sharing of information. It is becoming increasingly clear what works best and why. This book pulls the most practical ideas together and will help take this movement to the next level.

This builder's guide does that by providing simple, clear explanations of each step of construction, from earthbag foundations that don't require concrete, to complete information on tools and supplies, as well as tips, tricks and advanced earthbag techniques.

All major aspects of building earthbag houses with vertical walls are covered: Planning; Dirt cheap building techniques; Building code issues; Electrical and Plumbing; Cost estimating; Insulation; Landscaping options. It is profusely illustrated with about 185 color photos and detail drawings.

http://www.naturalbuildingblog.com/owens-book-dvd



Earthbag Architecture -- Building Your Dream with Bags

Authored by Kelly Hart, Foreword by Dr. Owen Geiger

Discover how you can build an amazing variety of structures using little more than the earth beneath your feet. Earthbag building is revolutionizing how people around the world are thinking about ways of providing shelter, both temporary and permanent. Such buildings can be remarkably durable and resistant to earthquakes, floods, fires and even bullets.

Kelly Hart describes the basics of how to build this way, provides a history of the evolving technology and delves into detailed descriptions of the many different earthbag projects that he has been involved with over nearly two decades. A survey of 64 unique buildings

from around the world proves just how versatile this approach to building can be. A look to the future of earthbag building and a Resource Guide complete the book.

Some 240 color photographs help you visualize the possibilities of this unusual and sustainable approach to architecture. https://www.createspace.com/5461815

Step-by-Step Earthbag Building

Earthbag building tools and supplies

My **Step-by-Step Earthbag Building article** at EarthbagBuilding.com has been updated. I built a demonstration wall and photographed each step. YouTube videos have been embedded to further demonstrate the process. All the latest tools and techniques are shown, including use of stronger sheetmetal sliders, 2-gallon cement buckets, bucket chutes, bags turned inside out, and filling bags to capacity with the same number of pre-measured buckets. Note how I demonstrate pre-tamping earthbags. This is a relatively new technique I developed to lengthen the bags so they have additional overlap. This step strengthens the wall, which is particularly important in earthquake regions.

The goal of this project was to simplify the explanation of how to build with earthbags, making it clear as possible. All too often people read the books and dozens or hundreds of web pages and still don't fully grasp the basics. So my advice is to read this article several times and then practice each step. Get the basics right and the other details will more easily fall in place.

http://www.naturalbuildingblog.com/updated-step-by-step-earthbag-building

Ancient Rammed Earth Structures

The Alhambra Palace overlooking the city of Granada, Spain was built 1,200 years ago.

Earthbag building and rammed earth construction are very similar. Both methods utilize earth that has been tamped solid. In the case of earthbag building, polypropylene bags or tubes contain the soil and eliminate the need for expensive forms. Since they are very similar in composition, we can reasonably speculate that earthbag houses will last for a very long time – possibly thousands of years – the same as ancient rammed earth structures.

It's worth emphasizing that earthbag building is not just bags of dirt stacked upon each other. The most common earthbag fill material is clay/aggregate soil mixture. In other words, most ordinary subsoil (mineral soil) that has enough clay to bind the sand and gravel together. When this mix is lightly moistened and tamped solid, it becomes densely compacted and extremely durable as evidenced by the following ancient structures.

http://www.naturalbuildingblog.com/ancient-rammed-earth-structures

Bullet Resistance of Compressed Earth

Earthco Building Systems, Inc. performed some interesting bullet resistance tests on their compressed earth Megablocks. In the video they used 50 cal "BMG" 661 grain Full Metal Jacket over a stainless steel core — muzzle velocity of 3100 fps and delivering 12,400 foot pounds of energy. Densely compacted earthbag walls made with subsoil would likely have comparable results. Maybe someone with a rifle and spare time could conduct a similar test on earthbags. Please email me and I will provide a few suggestions.

Test results using 50 caliber bullets on an unprotected 8 month old wall that received 10" of rain:
– 5-1/2" – 7" penetration
– 10" penetration with two 50 caliber rounds fired into the same hole
– 5 shots in 6" circle without full penetration on 18" thick walls
– little to no cracking

http://www.naturalbuildingblog.com/bullet-resistance-of-compressed-earth

Cost of Earthbag Houses

One of the most frequent questions people ask is "how much do earthbag houses cost?" It's a little difficult to answer because there are many factors that affect the total cost. A lot depends on what features you want to add, whether or not you have building codes, how much work is done by the homeowner, and the details of the building itself.

A small, simple house made of natural building materials could be built by a DIY builder for about $10/sq.ft. This assumes doing most everything yourself and using the low-tech building ideas explained on our websites. It doesn't include things like land, building permits and utility hookups, since the price of these things vary wildly.

Keeping in mind it is much easier and lower cost to build with earthbags in rural areas with minimal building codes, let's look more closely at one example. Here are the approximate

costs of a 15' interior diameter roundhouse with earthen plaster and floor, recycled materials where feasible, and reciprocal pole roof with sod on top.

Recycled earthbags @ .20/bag = $108
Soil = $100 (bag fill, plaster, floor)
Gravel bag foundation = $20
Barbed wire = $35
Roof poles = $25 (with firewood permit from national forest)
Salvaged barn wood roof decking = free
6 mil poly = $25 (for roof)
Reinforced concrete bond beam = $100
Doors, windows, hardware, bathroom fixtures, tile, etc. from yard sales/barter = $175
Sod = free
Plumbing/electrical = $200
Composting toilet = $20
Earthbags w/rice hulls ceiling insulation = $10
Reed mat ceiling = $40
Recycled wood for cabinets = $100
Nails, screws = $42
Total cost = $1,000

This works out to be less than $6/square foot for this 176 sq. foot roundhouse in a non-code area. I'm sure I'm forgetting a few things, but you could double this cost to cover gas and any extras and still have a nice little house for $2,000. Now you can see why we're so excited about earthbag building. It's a real game changer for those in need of affordable housing.

http://www.naturalbuildingblog.com/cost-of-earthbag-houses

How Much Do Earthbag Houses Cost?

This is probably the most common question of all: How much do earthbag houses cost? It's sort of like asking how much does a car cost? Well, it depends on the size, features, construction details and how much work you are willing to do. The short answer is it can cost as much or as little as you want.

A small, simple house made of natural building materials could be built by a DIY builder for about $10/sq.ft. This assumes doing most everything yourself and using the ideas listed below. It doesn't include things like land, building permits and utility hookups. Note: it's much easier to do these things in rural areas with minimal building codes.

Here are just a few factors that can dramatically change the cost:
– Foundation: gravel-filled bags on a rubble trench foundation replaces concrete and steel.
– Earthbag walls (usually just compacted soil) replace a whole range of expensive processed materials.
– Earth, stone or recycled brick floors. Think of all the lumber that goes into a typical wood framed floor and how much you can save.
– Earth plaster saves sheetrock, taping, texturing and a lot of paint. And of course, earth is dirt cheap.

– Rice hulls are great for insulation.
– Small diameter, sustainably harvested wood from local forests can save you a bundle.
– Recycled materials throughout (sinks, tubs, hardware, tile, shelving, etc. including bags if they're in good condition). This is one of the easiest ways of saving money. It just requires extra time.

So you can see this type of building doesn't fit neatly into a conventional estimating chart or program. There's no way I can say exactly what a house will cost. It all depends on local variables and how much people are willing to search for low cost alternatives.

http://www.naturalbuildingblog.com/how-much-do-earthbag-houses-cost

Creating Earthbag House Models

Clay model of earthbag home

Creating scale models is a great way to learn earthbag building techniques and help visualize your future home. Tim Merritt sent me some pics of models he's been working on and I was so impressed I wanted to share them with other readers. Tim used modeling clay for his models. Kelly Hart created models for his house using miniature sandbags sewn to scale. See his Miniature Bag Kit. The main point is modeling makes it easy to try out various configurations to see what looks and works best.

http://www.naturalbuildingblog.com/creating-earthbag-house-models

$300 Earthbag House – What the World Needs Now

The $300 Earthbag House was the 14th place winner in 'The $300 House' challenge. (Earthbag designs had a strong showing with #1, 2, 3, 5 and 14 place winners**.** No other building method came close to this level of success in the competition.)

The low cost of this design is almost certainly the main appeal. Whenever we run a story about dirt cheap housing like Straw Bale Roundhouses Built in One Day or Rex's $4/sq. foot Pallet House we almost always get a spike in traffic. This is the main point of this blog post – people want affordable housing! How obvious is that? It's terrible seeing tens of millions of people who can't afford a decent home even in a 'rich' modern country like the US. Most housing options, especially those made with highly processed materials such as steel, brick and concrete are not affordable, while those made with local natural materials such as earth, straw bales and wood poles are much less expensive. Look for rural areas with few or no building codes and you will reduce construction costs by many thousands of dollars.

Description of $300 Earthbag House: 11.1 sq. m. interior, 5.4 sq. m. sleeping loft, 11.2 sq. m. patio for cooking and socializing. Total living space = 27.7 sq. m. Single units can be expanded by adding on in any direction or joined to create multi-unit structures. Almost all materials are free or recycled: grain bags, rubble, clay, door, security bars, earthen plaster and floors, or locally available, natural materials: bamboo, rice hull insulation. All drawings and details for the $300 Earthbag House are provided for free.

A brief note about the cost: The competition organizers set a somewhat arbitrary $300 cost figure. They reasoned most slum dwellers could afford $300. Some people left comments that said no one could build a house for this amount. As I explained in my housing proposal, slum dwellers would scrounge almost all the materials for free or barter for as much as possible. They can't afford to buy new materials. But what about building something like this in a developed country? This home built with recycled materials and some new materials might cost around $2-3,000 in the US – still very reasonable by any measure. Also note, you could use various materials such as earthbags, straw bales, adobe, etc. Use what makes sense in your area.

http://www.naturalbuildingblog.com/300-earthbag-house-update-what-the-world-needs-now

This 27.7 sq. meter (interior) $300 earthbag house provides safe, decent, affordable shelter. It is owner built and can be expanded in any direction, or joined to create larger structures. The technology is well proven.

Earthbag building is one of the lowest cost and most sustainable building systems in the world. Earthbag building is based on 250 years of military use of sand bags for constructing fast, efficient, blast resistant structures, and decades of use in flood control. These same qualities can be applied to build durable, safe, simple, affordable housing, as demonstrated by the thousands of earthbag houses already built around the world.

https://www.jovoto.com/projects/300house/ideas/12500

Finished Earthbag Roundhouse

This is the finished roundhouse that we built in 2010. The walls were built during our April workshop, and plaster and finish work continued through May and June at a slower pace. To say the least, we've very happy with the results. If you want to learn more, you can search this blog for the keyword "roundhouse."

Earthbag roundhouse - exterior view

Micro-concrete roofing tiles on our earthbag roundhouse

After about three years of life on our vetiver thatch roof we replaced the thatch with micro-concrete roofing tiles (MCR). MCR tiles and metal roofing are fast and easy to install, and both work well for roofwater harvesting. I like MCR tiles because they're more durable and look better than most metal roofing, and don't get as noisy in rainstorms. We cut the tiles with a right angle grinder and then covered the joints with cement. This roof should last 25 years or more. Also note, the vents on top will provide even better ventilation. (They're screened to keep birds out.)

You can buy **simple machines to make your own MCR tiles**, although quality factory made brands are much more durable. We used the same type of roofing tiles on **our recycled house on our homestead**. The **original thatched roof** looked beautiful but was not very durable.

For more pictures, go to the **Picasa earthbag roundhouse photo gallery**.

http://www.naturalbuildingblog.com/finished-earthbag-roundhouse-video

$2,000 Earthbag House

This price, or something close to it, reveals the true cost of construction using earthbags. If you're paying substantially more, then your money is going toward inflated prices. Sure, things are more expensive in the US than Mexico, but watch the video and see what I mean. That $2,000 house would cost maybe $125,000 (or more) in many places of the US. Part of the solution is to build your own small, simple house and avoid credit.

http://www.naturalbuildingblog.com/2000-earthbag-house

Turkish Roundhouse Earthbag Update

This earthbag home in Turkey has survived three earthquakes.

Two years ago I found myself living alone in a tent in the Turkish hills. There was no power or running water on my land. It was the beginning of an adventure that profoundly changed my beliefs about what is possible, or enjoyable. In this site I share a few of the things I learned along the way, such as:
– How to make a cheap eco-home for yourself with zero skills.
– How to live completely off-the grid.
– That your best friend is the Earth (honestly).
– This site also includes some of the creative writing that the experience inspired.

It cost $5,000 to build this cosy eco-home. That price includes windows, doors and labour.

Earthbag is IDEAL for roundhouses. If you're in a seismic area like most of Turkey, then round is the way to go. Round is not only aesthetic and soothing to the spirit. Circles are the strongest structures you can build. Cars have been known to hit earthbag roundhouses with no more than plaster damage. Mine has survived a 6.1 earthquake and is in exactly the same condition it was when I built it.

I didn't even know what a joist was when I started this project, so if I can do it, anyone can. You don't need prior knowledge. You can learn the skills. But you do need to be flipping determined, flexible and a motivated team really helps.

It took 6 weeks to build this earthbag home and cost around $5,000. There was no power or running water on the land.

Be sure to check out the book **Mud Ball – How I Dug Myself Out of the Daily Grind**: Atulya K Bingham's personal journey of building this home as a single woman on an extremely tight budget.
http://www.naturalbuildingblog.com/mud-ball-how-i-dug-myself-out-of-the-daily-grind-atulya-k-bingham

http://www.naturalbuildingblog.com/turkish-earthbag-roundhouse-update

Half Moon Earthbag Earthship

Half Moon Earthbag Earthship

I'm very happy to see more details of this excellent design. We've been following the construction progress on their YouTube videos. Now, they've added a website with much more information. I have to say, this is one of my favorite designs. It is very well thought out, very affordable, very practical. I would love to include a photo of this home in my upcoming earthbag book. If you're the owner, please contact me.

The Half Moon is a kind of cabin in the mountains, built with some special features that make it livable and sustainable at low cost in its very remote, off-the-grid location. Like typical cabins in the mountains, it is intended to be used as a getaway place for the rest of my working life. It is also my hope to live in the Half Moon when I retire from full time work.

The idea was to build the shell of a cabin, built on earthship principles but with earthbags instead of tires. The structure would be my vacation (and/or disaster) refuge for the next five years, during which time I would finish it out to a more livable permanent residence. The systems and design, however, would be very simple: the smallest necessary 12 volt electrical system (enough to support 3-day visits) and no internal plumbing apart from cistern-fed drinking water. All waste would be forever composted, which ultimately would be placed in a future greenhouse.

The Half Moon was mostly built in July 2008. Prior to construction the site was excavated from a sloping area selected primarily because of its view of the mountains to the south. Excavation took place in one day in June, largely because of the preparation and skill of our operator, Mark.

If you're serious about building with bags, this plan is worth careful study. It's one of the few true zero energy homes out there. The Half Moon is averaging 63 degrees inside with no supplemental heating. And because of the owner's careful documentation, others can follow in his footsteps to take earthbag building to the next level.

http://www.naturalbuildingblog.com/half-moon-earthbag-earthship

Low-cost Multipurpose Minibuilding Made with Earthbags

Earthbag dome with living roof by Owen Geiger

One of the most practical structures on a small farmstead is a multipurpose garden structure that can serve as a storage shed or cool pantry above ground, or as a root cellar or storm shelter below ground. You can build this multipurpose structure for about $300 using earthbag construction (bags filled with earth and stacked like bricks). And the skills you learn by building the dome will serve you well if you plan to build a larger earthbag structure — or even an earth home.

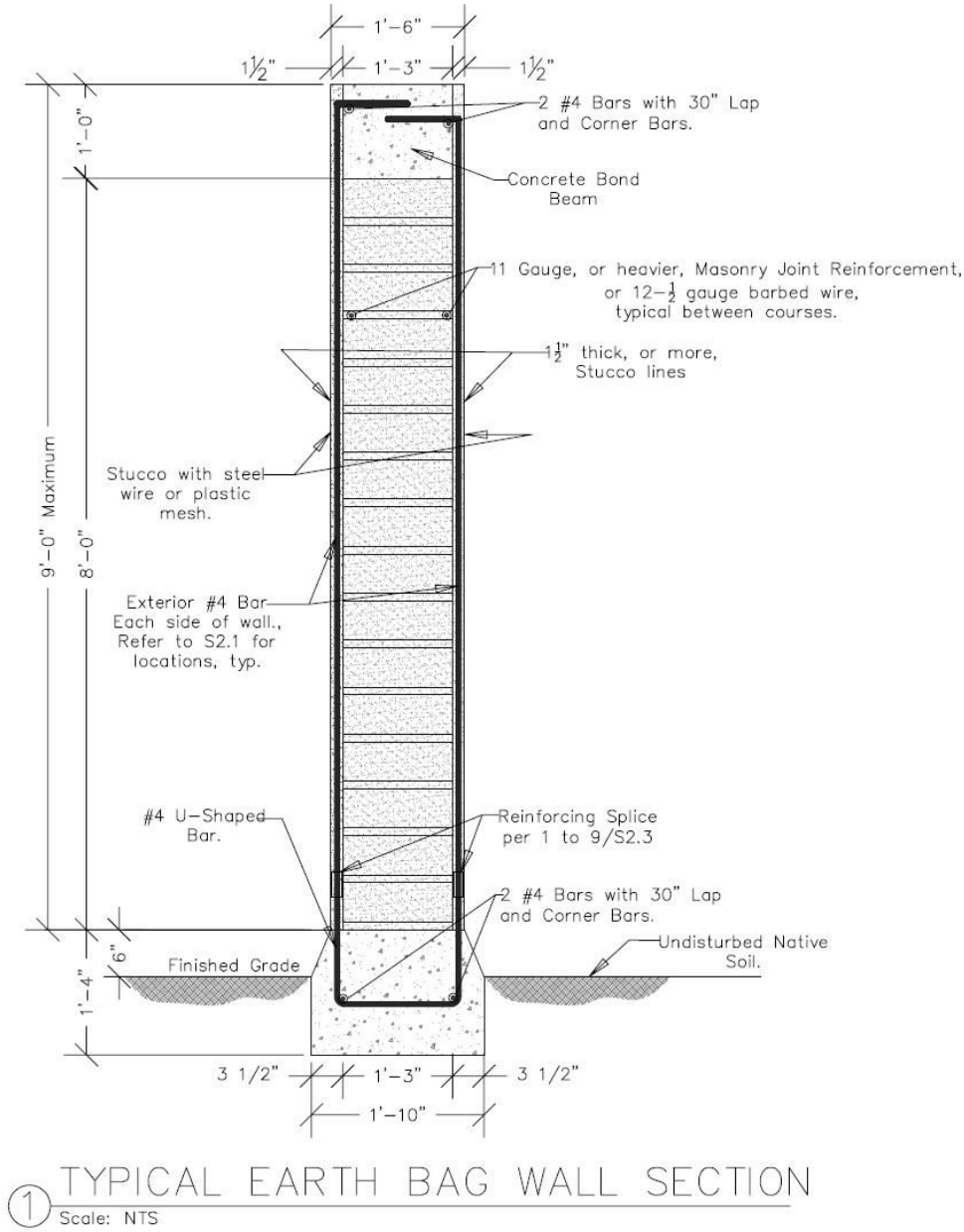
Earthbag structures provide a cool space in summer and an escape from the cold in winter, which means this earthbag dome is well suited for many purposes. Depending on your needs, the most practical combination of uses might be a root cellar/cool pantry for daily use and a disaster shelter for emergencies such as tornadoes or hurricanes.

Click here to read the entire 9 page article and view 11 photos and complete drawings: **Low-cost Multipurpose Minibuilding Made With Earthbags**

Click here to read the free Step-by-Step How to Build an Earthbag Dome Instructable at Instructables.com. http://www.instructables.com/id/How-to-Build-an-Earthbag-Dome

http://www.naturalbuildingblog.com/low-cost-multipurpose-minibuilding-made-with-earthbags

Reinforced Earthbag Specifications



Reinforced Earthbag Wall Section for Seismic Areas by Structure1.com

I am extremely happy to announce another major first for earthbag building. **Precision Engineering** has generously provided drawings and specifications for building earthbag structures in seismic areas to meet code. The documents have been combined into one 6-page PDF and are now available online.

Reinforced Earthbag Specifications is a 6-page PDF describing in drawings and text exactly how one might construct a reinforced earthbag wall that would pass most building codes in areas of high seismic risk. This document was prepared specifically at the request of Dr. Owen Geiger and Kelly Hart for use on reconstruction projects in Haiti, but it could be useful wherever reinforced vertical wall structures may be built. We want to acknowledge

and thank Nabil Taha of **Precision Engineering** for his patience and diligence in preparing this document.

This document is now accessible from **EarthbagBuilding.com** and **EarthbagStructures.com**

I want to emphasize what an amazing gift this is to the earthbag building community, and to those struggling in stricken areas such as Haiti. As far as I know, this is the first time an engineer has published their drawings and specifications in this manner. It's truly a pioneering document. There is no big industry driving this movement that can pay for tests that costs hundreds of thousands of dollars, and so we rely on expert advice to take earthbag building into mainstream use.

http://www.naturalbuildingblog.com/reinforced-earthbag-specifications

Specifics of Nabil Taha's Engineered Earthbag Designs

I posted the recent news about gaining engineering approval for earthbag construction through **Precision Structural Engineering**, Nabil Taha's engineering firm in Oregon. He is licensed in 27 states and has developed an earthbag building system to meet international building codes. This is a major step forward for gaining widespread acceptance of earthbag building and we are very appreciative of his leading role and support.

The following engineering guidelines are quoted from the **PSE website**:
– Earthbag building utilizes the ancient technique of rammed earth in conjunction with bags and tubes as a flexible form. Earthbag construction does not require as much time, attention, or forms as adobe or rammed earth construction requires.
– The fill can be on-site soil or other local materials. Depending on the needs and uses of the completed project, certain materials are selected for either insulation or providing thermal mass. Generally, the fill is of a mineral composition and not subject to decay.
– Because these structures can take an endless variety of shapes, the need for traditional building materials, such as wood or steel, is negated. This saves both energy and precious natural resources.
– When construction is performed in the right way, earthbag buildings have been proven to withstand the ravages of fire, floods, hurricanes, termites, and earthquakes.
– Earthbags can be stacked for a number of different building types and shapes.
– Round is sound, round or circular shaped earthbag homes/buildings are very strong, and can resist the wind and seismic forces better than rectangular buildings.
– Earthbag buildings do not have to be round, circular or curved.
– The earthbag system, in conjunction with the design of monolithic shapes is the key to the earthbag structural integrity.
– Different materials have been successfully used for earthbag construction such as sand, dirt, crushed volcanic rock (scoria), etc.
– A good mix is approximately 70% sand and 30% clay.
– To prevent the earthbags from sliding relative to each other, barbed wire is always used between earthbag courses.

– Masonry equations can be used for earthbag wall designs.
– The Building Code requires a minimum amount of reinforcement to be used for earthbag construction. The following amount/area of steel can be included in the Code minimum requirement amount of steel: steel mesh in the plaster/stucco, steel bars in the bond beam, barbed wire or the joint reinforcement used between the courses/rows of earthbags.
– At the top of the earthbag wall, providing a concrete bond beam with 2- # 5 bars is recommended.
– Earthbag wall thickness should be 16 inches or more.
– Building codes do not allow generic prescriptive designs that can be applied to all earthbag structures. (Each structure must be analyzed on a case-by-case basis.)
– The best information we have found about bags for earthbag building is Frequently Asked Questions at Earthbag Building.com."

http://www.naturalbuildingblog.com/specifics-of-nabil-tahas-engineered-earthbag-designs

Earthquake-resistant Earthbag Houses

Earthbag Sun House in Haiti was undamaged by recent earthquake

Nearby structures were severely damaged

It deeply saddens me to see one disaster after another occurring around the world, especially since much of the tragedy could be prevented by building earthquake-resistant earthbag houses.

The recent earthquake in Haiti is but one more example of this. Theo (Father Marc Boisvert) runs a project for the poor in Haiti. Their earthbag **Sun House** fortunately escaped unscathed even though nearby structures were devastated. According to **Theo's blog** "…no one hurt and no structures damaged."

Note: the Sun House example by itself is not conclusive proof of seismic resistance. More testing is called for, but anecdotal evidence and test results keeps growing and so far is extremely compelling.

Bryce Daigle's testing and thesis, for example, details how earthbag walls obtain maximum compressive strengths almost 10 times as great as those typically achieved by conventional stud-frame housing in terms of load per metre of wall length. **Testing Proves Earthbags Very Strong**

Nadir Khalili's tests in Hesperia, California demonstrated how earthbag structures exceeded the strength of the testing equipment with no deflection or failure, and received code approval in the most dangerous level — seismic zone 4.

Properly built reinforced concrete structures, which can be engineered to high earthquake-resistance, are not affordable in Haiti and countless other areas around the

world. So even if building codes are in place, builders in these areas will find a way to circumvent them. That, and excessive codes will prevent people from building affordable housing. After years of studying the situation, earthbag and strawbale construction appear to be the most practical solutions.

Additional resource: **Earthbag Testing page** http://earthbagbuilding.com/testing.htm

http://www.naturalbuildingblog.com/earthquake-resistant-earthbag-houses

No Earthquake Damage to Rammed Earth Monasteries

Rammed earth Kagbeni Monastery

A nice lady in Nepal just told me there was no earthquake damage to the rammed earth monasteries in the Himalayas after the recent earthquakes. In fact, most of these structures have survived earthquakes for centuries.

This is important because earthbag building is basically rammed earth in bags. Actually, I believe earthbag is stronger because of the added rebar, barbed wire and concrete bond beams.

Hemendra Bohra of **Matoghar Builders**, a local builder here sent me the following info and photo:
"Here are some pictures from my trip to Mustang some weeks ago. Kagbeni Monastery was built in 1429. Rammed earth is also popular in Ladhakh (India) and Bhutan."

Regards, Hemendra

According to Narayan Acharya of Rammed Earth Solutions, none of their projects experienced any earthquake damage. Now they are building a rammed earth hospital that is very involved. **Rammed Earth Solutions**

http://www.naturalbuildingblog.com/no-earthquake-damage-to-rammed-earth-monasteries

Earthquake-Resistant Earthbag Building Details

There's obviously a great deal of concern about the recent earthquake in Haiti. Disasters like this are all too common, and so we're working hard to develop at least two low cost, easy to build earthquake-resistant earthbag house designs.

We hope to be better prepared in the future with plans 'ready to go.' But in the meantime, we are making good progress. Kelly Hart and I have roughed out some basic design details. Adobe engineer Bill Druc has offered to help with the calculations and designer Patti Stouter has offered to do some drawings. Also, numerous organizations have expressed interest in raising donations, sending building materials and trainers, and constructing houses in Haiti. For the latest news, see Comments at **Responding to Catastrophe**.

Earthbag buildings tend to flex and distort during an earthquake rather than suddenly collapse as wood framed, adobe, brick and concrete block structures do. Barbed wire and plaster mesh hold the bags together in case of collapse, thus greatly reducing risk of people getting crushed.

Key building details for earthquake-resistant earthbag houses in Haiti:
– Use compact shapes for greater seismic resistance: round, curved, hexagonal, octagonal shapes or domes when culturally appropriate.
– Avoid long unsupported walls.
– Foundation: gravel-filled earthbag foundation (double-bagged for strength) on rubble trench. Best to have at least two continuous courses of earthbags below door threshold.
– Barbed wire: two strands of 4-point barbed wire between courses
– Limit the size and number of doors and windows: these may be available from collapsed buildings or acquired locally to save shipping space. No glass in windows, only shutters that can be locked. Concrete breeze block or screened openings can reduce number of windows required.
– Steel-reinforced concrete bond beam: 6" high x 16" wide
– Truss anchors in the bond beam: embed L shaped rebar anchors or truss anchors at 24" on center and weld or bolt to rafters/trusses
– Lightweight roof: about 3:12 pitch, metal roofing for roofwater catchment
– Plaster mesh: poly fishnet is the lowest cost, won't rust and can easily be stuffed into barrels full of building materials. (Barrels are later used for roofwater collection.) Add fishnet to both sides of earthbag walls and connect with poly twine.
– Plaster: cement or lime plaster on exterior; earth plaster on interior

Virtually no structure can withstand a direct hit from a major earthquake, but by combining the building details listed above there is a very good chance the structure will hold together even if the walls should topple. While not perfect, this strategy could save countless lives over the current building methods used in Haiti.

30 Earthquake Resistant Earthbag Houses in Mulabari, Nepal

Safe, affordable, earthquake resistant earthbag houses in Mulabari, Nepal

I wanted to share more of what we saw while touring earthbag projects near Kathmandu. **Carisimo**, a German-based NGO, have built 30 earthbag houses in this village using young foreign volunteers and local families. This is the largest earthbag housing project in Nepal that we know of.

Mulabari is high in the mountains on a steep, terraced slope several hours west of Kathmandu. Each house measures 9 x 13 feet interior. That's small by Western standards, but the houses felt very cozy and comfortable inside. The earthbag walls were built in 7-10 days each. Families worked in groups of 10 to build each others' houses, and over time the groups were building their houses unsupervised. We watched the workers (primarily women) lay the earthbag tubing on one wall in about five minutes. This doesn't include the time to fill the buckets with soil, but still it shows how fast earthbag building can be particularly when using polypropylene tubes instead of bags. Tubes are faster, easier, less expensive and readily available in Kathmandu in giant rolls.

The most interesting thing was seeing the evolution of the houses over the last 8 months during our 3 hour tour. Each house on the tour was stronger and better built than the previous ones. There are massive earthbag buttresses on every corner (which make it easy to add new rooms later), and buttresses near the door (the weakest area). One house even included a second story made of lightweight framing and corrugated metal siding, plus

wrap-around porches that mimics traditional Nepali style. The core earthbag portion was identical to the others. This goes to show how small, simple houses can be expanded over time both upward and outward. One house has a curved wall to demonstrate how families can create their own adaptations.

The workers did an outstanding job of building safe, cozy, durable and attractive houses on a very tight budget of $900 per house. However, the limited funding meant taking several shortcuts to reduce costs. The main problem at Mulabari was hiring a tour guide with no construction experience as the supervisor. Carisimo has since partnered with Good Earth Nepal in another village called Kaule to continue building earthbag houses with more professional and reliable site management. Carisimo also agreed to a higher budget to upgrade the design and pay for a professional site supervisor and site evaluations by an engineer. These added measures will go a long way to build stronger, more durable houses that will reduce risk for everyone concerned.

http://www.naturalbuildingblog.com/30-earthquake-resistant-earthbag-houses-mulabari-nepal

Earthbag Women's Centre in Vanuatu Withstands Category 5 Cyclone

The earthbag Erakor Women's Center withstood Cyclone Pam and helped local families survive.

Cyclone Pam, one of the worst cyclones ever recorded in the Pacific Ocean, blasted the island chain of Vanuatu with category 5 winds up to 185 miles per hour and 26 foot storm surge. The women's earthbag center near Port Vila and the earthbag water tank made it through the storm with minimal damage, despite the widespread destruction in the region. As much as three-quarters of the houses in Port Vila were either destroyed or severely damaged. The Wall Street Journal said up to one third of the population may be homeless. Fortunately, some families on Erakor Road were able to safely shelter in the women's center earthbag roundhouse as the storm passed through. Project manager Liz Sherborne said "the trees are all gone. It stands alone on the hill. Paint hardly scratched. Lost three sheets of tin." This news impressed **Bundaberg Bag Company** enough to donate 1,000 meters of polypropylene tubing to build more earthbag structures and water tanks. According to Liz, "now everybody wants one."

From News Mail:
"Among the small percentage of structures left standing in Vanuatu following the devastation of Cyclone Pam are those made from bags.

The Bundaberg Bag Company has donated 1000m of woven polypropylene tubing to enable volunteers to build more structures using the earthbag process. The bags are filled with dirt before being rendered over with cement and are both cyclone proof and earthquake resistant.

More at the source: **News Mail**
Note: This type of experiential evidence accumulated over time is what will eventually push earthbag building into code acceptance and more mainstream use. Same thing happened to strawbale building and now it's code approved. It just takes years and tons of money to

prove the obvious. We'll soon see how many code approved structures were leveled in Vanuatu. And thank goodness for the earthbag water tank. There's a severe shortage of drinking water and some locals are resorting to drinking sea water. Many of the plastic water tanks were destroyed or tipped over. Local stores are no doubt sold out of bottled water.

For new readers, please check out the links on the right side of the page. We have thousands of pages of free information that show and explain everything in detail. There's even a special site for building in developing regions and disaster regions called Earthbag Structures.com.

Related: **Earthbag Water Tank Instructable**
http://www.instructables.com/id/Earthbag-Water-Tanks

http://www.naturalbuildingblog.com/earthbag-womens-centre-in-vanuatu-withstands-category-5-cyclone

Hurricane and Tornado-Resistant Earthbag Houses

Domes are very strong and perhaps the best option for many areas. However, in rainy climates they are prone to leaks. (Domes originated in desert regions, after all.) In high rainfall areas, roofs with overhangs to protect walls are recommended. Roofs need to be very well built with hurricane tie downs. This is the weakest link in the design because roofs are vulnerable to wind damage, so study up on the specialized building techniques available.

Consider something like this **Sand Castle** house built by Steve Kemble and Carol Escott. Round, hexagonal or octagonal shapes are all good choices because wind will flow around the building. Same idea applies to the roof.

One big consideration is building on grade versus building on piers off the ground. Try to find some high ground and build on grade (or 1'-2' above), since this will be stronger and less expensive.

Bag fill: The crushed coral/sand mix used on the Sand Castle is a good choice if available locally. Road base is more commonly available and can be stabilized with lime. Road base is the clay/gravel mixture used to build roads. It's cheap, plentiful and very strong. And with lime added, walls become virtually waterproof and almost as hard as concrete.

One story structures reduce exposure. Design in fast mounting storm resistant window shutters. Keep roof overhangs to a minimum, maybe 24" , to help prevent uplift.

So in summary, a properly designed earthbag structure is the strongest sustainable building system that I know of. The only thing stronger is reinforced concrete, and that's not sustainable.

http://www.naturalbuildingblog.com/hurricane-and-tornado-resistant-earthbag-houses

Earthbag Benches: The Perfect Starter Project

Completed earthbag bench

Many readers are hesitant to plunge in and start building an earthbag house. That's understandable. Building any home is a major undertaking and it makes sense to plan accordingly. The best advice for those just getting started (after doing the prerequisite background research) is to build something small like a storage shed or earthbag bench. Earthbag benches are very easy to make, inexpensive, durable and low risk (come on, what can go wrong?). They only take about three hours to build, making them a perfect weekend project.

Here's the basic process. Select a nice relaxing spot, and then decide on the size and shape. Curves are great and naturally stronger than straight benches. It's best to build on a trench filled with 12" or so of gravel or concrete rubble. Use gravel-filled bags on lower course(s) until you're above the high water level, and tamped soil-filled bags on additional courses. Put a loop of barbed wire between courses to prevent slippage. If the bench adjoins your house like ours does, add extra barbed wire to connect the bench with the wall.

The last step is plastering; either lime or cement will work. You can add natural iron oxide pigments to the plaster and create virtually any color imaginable or paint it. We originally planned to paint our bench the same color as the house (cream color). That idea lasted about 5 minutes, when we realized our dog's muddy paw prints required a dark color. (Brownie, our dog, loves the bench and the cool floor inside.)

http://www.naturalbuildingblog.com/earthbag-benches-the-perfect-starter-project

Cold Climate Earthbag Yurts

There's great, untapped potential for superinsulated earthbag buildings in cold climates. Here's a way to combine the best features of earthbags and yurts. The basic idea is to combine earthbag walls filled with lightweight insulation such as scoria (lava rock), with a traditional yurt roof frame that's insulated with perlite or vermiculite.

Yurts (ghers) have been used in Mongolia and other areas for centuries. Traditional yurts are well suited for cold, windy places, in part because the wind just blows around them. They can, however, be made even more comfortable with extra insulation in earthbags.

Scoria is perfect for superinsulated earthbag walls: low cost, all natural, rot proof, fireproof, doesn't attract pests, lightweight and easy to work with. Scoria is great for building walls since the aggregates tend to lock together and form stable walls. Tie courses together with twine for best results, and then cover walls with canvas.

Yurt roof frames are readily available through numerous suppliers, and fast and easy to assemble. The steel tension cable is strong yet light. They are very resource efficient, using minimal wood, but often lack adequate insulation. I recommend tying bags of lightweight insulation to the bottom of the frame. Perlite and vermiculite would be excellent choices for ceiling insulation since they're very lightweight.

This design is portable, just like traditional yurts. The entire structure can be disassembled and transported if necessary. This would be a dream structure for places like Minnesota, Canada, Alaska, Siberia and Mongolia because it would be super comfortable, inexpensive, portable, wind resistant, owner built and could be built in many sizes. Add a skylight, rocket stove, small solar panel and composting toilet and then you can laugh at the wind howling by.

Note: you can use recycled bags if available (often farmers have them). You can also order tubes from poly bag suppliers. They make custom sizes. Tubes are faster to fill since you don't have to stop and tie the ends as often. A 12″ tube (measured when empty) that provides 10″ of insulation when filled would be ideal for many cold climates. Simply tie the tubes to the yurt frame with twine. Use whatever insulation is most practical in your area.

http://www.naturalbuildingblog.com/cold-climate-earthbag-yurts

Earthbag Building in Cold Climates

Added layer of insulated fill next to the earthbag

Most earth structures such as adobe are located in hot, dry climates. But what if you live in a cold climate and want the benefits of low-cost earth building techniques? Earthbag building has the unique advantage of providing either thermal mass or insulation, and therefore can be adapted for cold climates with an insulated fill material. Scoria, pumice, perlite, vermiculite or rice hulls could all be used for insulation.

One possibility is to add a seam lengthwise down earthbags or polypropylene tubes to divide them into two compartments. The outer part could be filled with insulation; the inner part with soil. This would create an insulated wall with thermal mass on the interior. For many situations, this is an ideal wall system.

The placement of the seam could vary, depending on the climate. In a mild climate like New Mexico, I would add about 4”-5” of insulation on the outside. This would provide about R-10 insulation. In a slightly colder climate the seam could go down the middle (50% insulation/50% soil). In extremely cold or extremely hot climates I would fill the bags with 100% insulation (or all earth in a hot climate if insulation wasn’t available).

See my How to Build an Insulated Earthbag House Instructable
http://www.instructables.com/id/How-to-Build-an-Insulated-Earthbag-House

New Soil Testing Guide

Shake test for earthbag building

Patti Stouter has expanded and updated her soil testing guide **Soil Tests for Earthbag**. We've added the report to our Earthbag Structures.com and Earthbag Building.com websites, where you can find in-depth information on every aspect of building with bags.

Using the right soil is very important. After all, earthbag building uses soil as the primary building material, and so you want soil that is strong and stable. Patti walks you through the various types of soil and explains simple low-tech tests for each.

http://www.naturalbuildingblog.com/new-soil-testing-guide

The Most Bang for the Buck? Part 1

What's the most efficient, cost-effective way to build with earthbags? How can you enclose the most space with the least time, effort and money? Well, it depends in part on climate, individual skills and preferences as far as styles/building types. (Other factors will be covered in a future post.)

In general, round shapes are the most efficient. They create the most amount of floor space for a given wall length. This is easily demonstrated by drawing a circle and a square using the same lineal distance of walls. For example, draw an 18' diameter circle, which will have an area of 254 square feet and circumference of about 56.5'. Divide 56.5 by 4 (= 14.1') to obtain a square with the same total wall length. A square with 14.1' per side has an area of about 200 square feet. So in this example there's a gain of 54 square feet of floor space. (Draw this with your kids. It's a great learning experience.)

So why do builders churn out square/rectilinear structures? Because modern building materials are rectilinear – plywood, OSB, sheetrock, etc. But we know these materials are energy intensive, costly, lead to monotonous designs and have negative impacts on the environment. Earthbag building frees us from these constraints and enables the use of more efficient round shapes. In addition, round shapes are inherently more stable. "Round is sound" as they say.

Size is also important. Large houses require much more time, labor, skill and materials and can easily wear you down, even more so for owner-builders. It's far better to build only what you need. You can always add on later. Build with cash one stage at a time.

Another factor to consider is fill material – what goes in the bags. Lightweight materials such as scoria are much faster and easier to use than soil. This one factor alone can cut the labor by severalfold, because scoria is lightweight, easy to work with and requires less tamping. Scoria is insulating and so it's ideal for extreme climates. Plus, scoria doesn't rot, burn, attract pests, etc. One limiting factor is it's less stable in certain applications such as straight walls and tops of domes that curve in too quickly.

And the winner is? I'll give it a tie between roundhouses and domes, depending on the variables listed above. Small to medium sized roundhouses with simple roof designs have an edge in many cases, especially rainy climates and for those with carpentry skills. In dry climates, domes may be more efficient. Organic shapes that approximate circles are a close runner-up, although this often complicates roof construction.

http://www.naturalbuildingblog.com/the-most-bang-for-the-buck-part-1

The Most Bang for the Buck? Part 2

Part 1 discussed the most efficient, cost-effective ways to build with earthbags. This post discusses a few related items.

Building site: Follow these steps and you'll save lots of time preparing the site and reduce the risk of problems in the future. Choose a building site that's clear of obstacles and naturally higher than the surrounding area so water will drain away from the structure. Do not build in flood-prone areas. Building on rocky ground or gravelly mineral soil on high ground is best. Make sure there is truck access.

Soil: Buy suitable soil (approximately 30% clay, 70% sandy soil) and dump it in several piles around the building to minimize labor. Trying to save a few dollars here by hand digging the soil will cost you a lot in time and labor. If you can, buy soil that's free of large rocks and large clumps of clay, roots and other organic materials, and needs no screening, mixing or additives.

Foundation: The fastest foundation is gravel-filled bags on a rubble trench. Scoria-filled bags are my preference, but most any local gravel will suffice. Scoria is easy to work with, lightweight and insulating. For a small house, you can have a scoria insulated foundation built in about one or two day's work with a few helpers.

Use salvaged materials when practical: I'm not recommending leaky single pane windows, of course. Most salvaged materials are a real bargain and usually impart a lot of character that's missing in sterile modern homes. It takes time to locate recycled materials, but the effort is typically well worthwhile.

Use low cost natural materials: This can save you a ton of money: earthen plaster, clay, tamped earth floors, road base, sand, gravel, stone, small diameter wood, rice hulls for insulation, straw, reeds, bamboo, thatch.

http://www.naturalbuildingblog.com/the-most-bang-for-the-buck-part-2

Using Scoria for Earthbag Building

Scoria, a type of lava rock, is excellent for earthbag building.

If you've been reading our blogs and websites, you'll often see reference to scoria. Scoria, also known as lava rock, has numerous properties which make it a great building material. The key breakthrough for earthbag building was **Kelly Hart's house** made with bags of scoria. His house stays comfortable year round in a very cold climate. This blog post recaps some of the most practical applications of scoria-filled earthbags.

Scoria is perfect for superinsulated earthbag walls. It's low cost, all natural, rot proof, fireproof, doesn't attract pests, and is lightweight and easy to work with. Anyone can handle bags of lightweight fill material such as scoria by themselves. It's almost like handling bags of popcorn.

Previous posts have explained how to build insulated earthbag houses with scoria. **Insulating Earthbag Walls with Tube Sandbags** describes how to use tube sandbags filled with scoria as an outer layer of insulation. **Earthbag Building in Cold Climates** explains how bags can be sewn to create two compartments – earth in one side and insulation in the other. In extremely cold or extremely hot climates I would fill the bags with 100% insulation (or all earth in a hot climate if insulation wasn't available).

Earthbag foundations offer many advantages over reinforced concrete foundations and work well with many types of sustainable buildings. In particular, they are low-cost, fast and easy to build, require no cement (a major expense and cause of global warming), and require no forms or expensive equipment. Scoria-filled bags create a shallow, frost-protected foundation, and therefore eliminate the need for rigid foam insulation and extensive excavation. This one step alone could save you thousands over conventional foundations.

Earthbags are ideal for building greenhouses due to their resistance to moisture damage. When filled with insulation such as perlite or scoria, earthbag walls and foundations enable you to grow plants year-round.

Kelly Hart's free **Dome Building Guide** shows step-by-step construction of how to build earthbag domes. His method of using scoria-filled earthbags is the easiest, fastest dome

building method that's been developed so far. Scoria is great for building domes since the aggregates tend to lock together and form stable walls that can withstand high compression loads. Tie courses together with twine for best results.

http://www.naturalbuildingblog.com/using-scoria-for-earthbag-building

Earthbag Scoria Casita

Here's another great project. This small domicile demonstrates how scoria homes are faster and easier to build than bags filled with soil, and more insulating. This doesn't mean standard soil-filled earthbags are obsolete. There are pros and cons to each system, however, I strongly encourage using scoria bags (or pumice or other suitable lightweight fill material) if there's an affordable supply. Thanks to Joe for taking the time to document everything and share what you've learned.

"Hi Owen. Wanted to let you know I just uploaded 10 new videos on my YouTube site. One is a portable solar water pump, all others are on our earthbag building.

I've been keeping close track of our labor and expenses. We've only been able to work on the building for 5-7 days at a time, several times a year so it seems to be taking a very long time. However, I added up our hours so far and was pleasantly surprised. To get to our 8′ height, ready for the bond beam, including digging the foundation, laying bags, framing and providing lintels for several windows / door openings, putting in a main beam with floor joists for loft:
392 RUNNING TOTAL HOURS
392 hours is only 9.8 40 hour weeks. If you could extrapolate this to a crew of 4 this would be about 2 ½ weeks!!!

Thanks once again for your advice, and thanks to you and Kelly for keeping up your wonderful earthbag sites. Feel free to use this info."
Joe

You can watch all his videos at **Festimr's Channel**. (Required viewing for serious earthbaggers.)

http://www.naturalbuildingblog.com/earthbag-scoria-casita

Using Earthbags as Ceiling Insulation

Scoria can be used as rot proof and fire proof ceiling insulation.

There seems to be a general lack of interesting ceiling options using sustainable building materials. For instance, when touring otherwise beautiful straw bale homes one often sees sheetrock covering conventional industrial insulation. Instead of using fiberglass batts or even manufactured cotton batts to insulate a roof, it is possible to use earthbags that are filled with a variety of insulating materials. These materials include rice hulls, crushed volcanic rock (such as scoria), vermiculite and perlite.

The insulating value of these ranges from about R-2 to R-3, so they are quite effective, and can also be quite inexpensive to install.

The full article at Earthbag Building.con also describes how one might use mats made of natural fibers to cover and finish these earthbag ceilings.

Suspended ceilings, as described in this article, have a number of benefits. They conceal the roof structure, plumbing, venting and electrical wiring, as well as improve acoustics and insulation. And they can also greatly enhance the ambiance or hominess of a room.
http://www.naturalbuildingblog.com/using-earthbags-as-ceiling-insulation

Earthbag Rootcellar

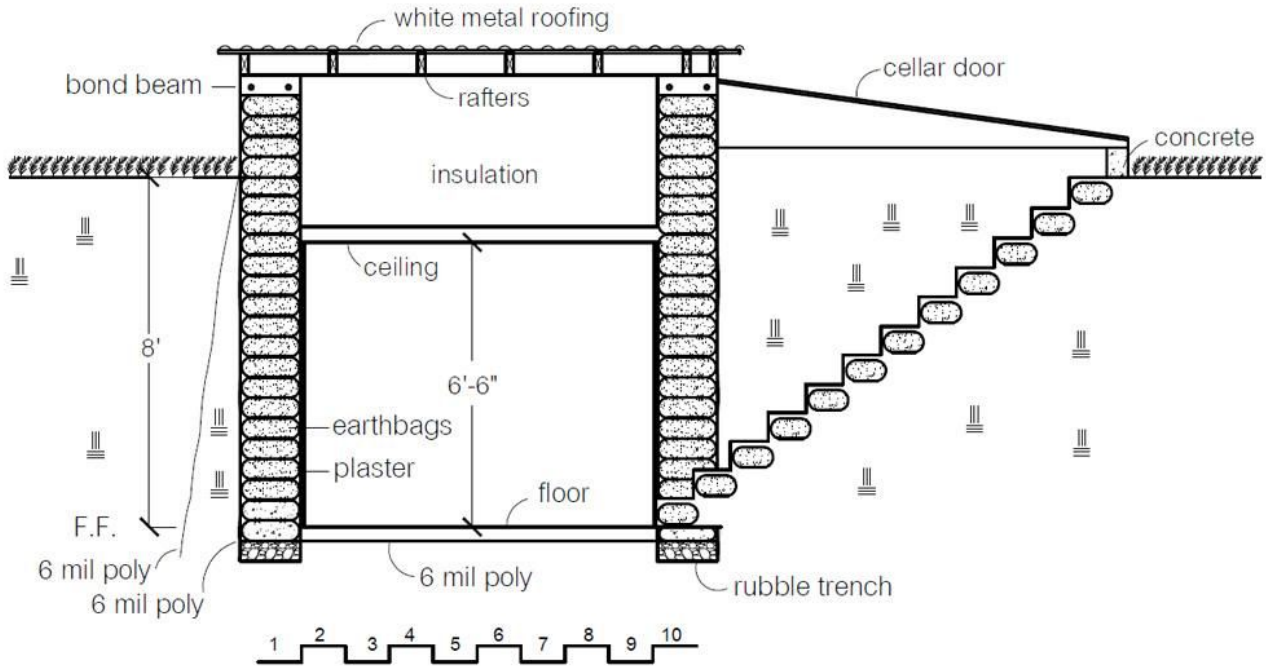
Earthbag rootcellar with ferrocement vaulted roof

Here's a real nice earthbag/ferrocement rootcellar plan from Karl in the Missouri Ozarks. It is 8' across, has 2' of soil on top and beautiful stonework in front. Great job Karl!

Karl describes his rootcellar in more detail: The U-shape on the top of the bags is a row of cement beam block that will hold the entire roof to the bags via re-bar pounded down into the earth bags. I opted for this instead of using bags to create my arch because I plan to pile a bunch of dirt on top of the root cellar and I believe this will be stronger. We'll grow some ground cover over the top of the rootcellar and pump house.

http://www.naturalbuildingblog.com/earthbag-rootcellar

Free Earthbag Rootcellar Plans



Earthbag rootcellar section view

Rootcellars have always been a hot topic among earthbaggers and homesteaders and other self-sufficient folks, so when Luke, who has been very helpful running the **Earthbag Building Blog Facebook fan page** asked for input on a rootcellar design, I was happy to help.

Earthbag rootcellar features:
– Standard 15” earthbag walls with lower courses filled with gravel (18”x30” bags or tubes)
– Optional insulated room with 12” walls for a freezer
– Superinsulated shed roof
– White metal roofing to reflect sunlight
– Earthbag steps covered with cement plaster
– Cellar door to keep rain and snow off the stairs (and prevent flooding)

http://www.naturalbuildingblog.com/free-rootcellar-plans

Sand Bag Fish Pond

Sand bag fish pond. Click on link below to see the beautiful finished result.

The pond is lined with black plastic but the pond is supposed to look like a natural jungle pond (ideally a peaceful zen-like pond) which you might stumble upon while hiking in the jungle so the black plastic needs to be hidden. We found out after we had all the rocks in place that one side of the pond was a little high so it was difficult to hide the black plastic on that side with rocks. We also realized that the best way to hide the plastic is to have a shelf of rocks a little way below the top level of the pond. We are achieving this by pulling out one layer of sand bags on the high side. It is also necessary to back fill dirt very close to the edge so that we can root plants that will drape over in places and also look natural. The plastic will loop up a little behind the low level of rocks before we back fill with more rocks and dirt. This will contain the water when we bring the level of the pond up again.

http://www.naturalbuildingblog.com/sand-bag-fish-pond

Strawbale Building

Code-Approved Strawbale Building Systems

Code-approved post and beam strawbale house. Note tarpaper on wood frame.

"The current code approved method for straw bale construction that can resist wind and seismic forces is not shown in the International Residential Code, IRC or the International Building Code, IBC.

However, it is shown as an appendix to some state residential code such as Oregon Residential code, appendix R, Straw-Bale Construction. The provision of this appendix is applicable to single family detached structures and related accessory structures as defined in Section R101.2, utilizing straw-bales in the construction of wall systems. So, if someone wants to build a straw bale home without the need to hire a licensed Engineer or Architect, he/she will need to check with their local building department to see if they have adopted the appendix.

Currently, the International Code Council (ICC) committee is working on a more advanced and better prescriptive method for straw bale home that is still on the development stage. The method will be much easier and better and will be applicable to straw bale homes with bigger openings than the old one. The work is not approved yet for use. For now refer to APPENDIX R STRAWBALE CONSTRUCTION. (Update: see next article below.)

The structural system/framing for these are usually post and beam beams for vertical loads. The straw bales are used as infill between the columns to provide excellent insulation for the wall. I met some owners of these beautiful homes who told me that they are saving 80% compared to stick framing houses of the same size.

Advantages of the post and beam system:
- More design options.
- Two story construction.
- Easier code approvals.
- Roof up quickly.
- Familiar construction techniques.
- Straw bale construction has been used across the world for commercial applications.

http://www.naturalbuildingblog.com/code-approved-strawbale-building-systems

National Straw Bale Building Code is a Go

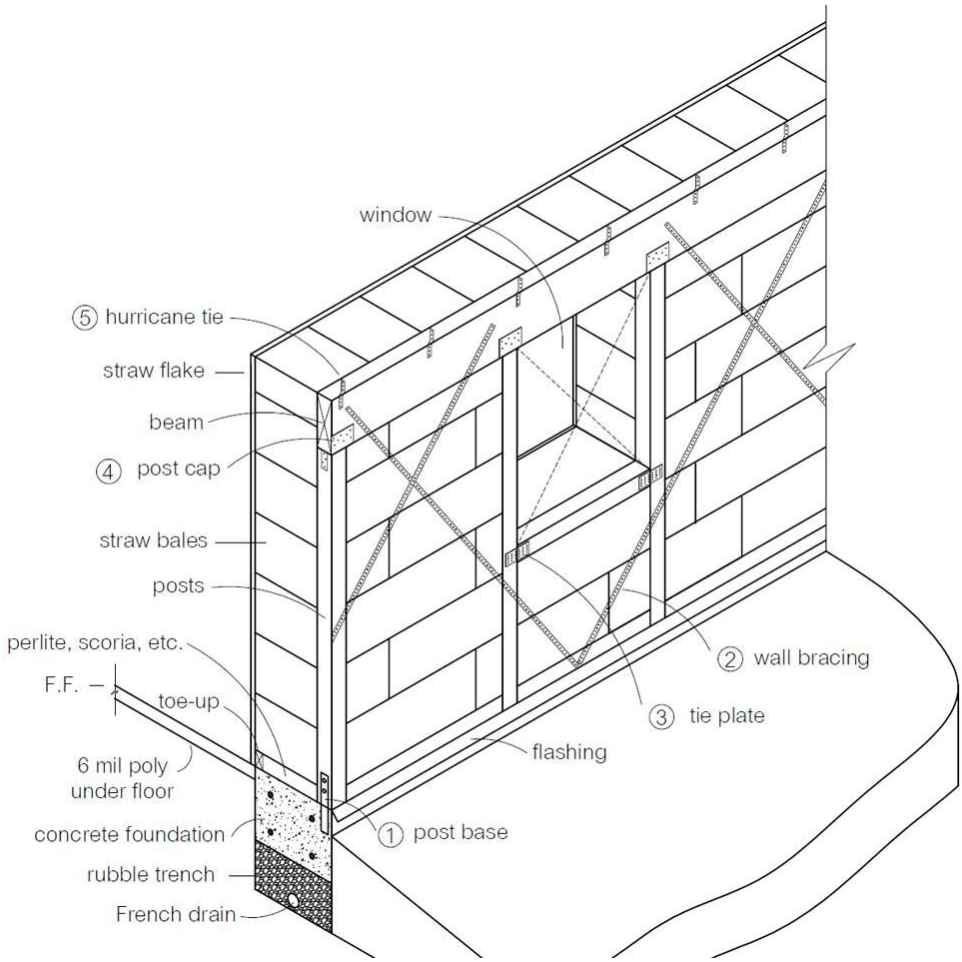
"Thankfully, we've never had to worry ourselves about local building codes, but there are many, many more folks who regularly struggle with codes when attempting to build a natural home in their area. And so the following news is very welcome, not just for those folks, but for a potential ecological/cultural tidal shift, as well. Earlier in October, an appendix on straw bale building was approved for inclusion in the 2015 International Residential Code for one and two-family dwellings. The IRC is basically the foundation for building codes all across the US. Wow!

Here's more details and commentary from Andrew Morrison of Strawbale.com about this great news:

The IRC is the basis for the Residential Building Code in virtually every jurisdiction in the US. So once these jurisdictions adopt the 2015 IRC, there will be a straw bale code for almost every jurisdiction in the United States. No more convincing building inspectors that your idea isn't crazy. No more wondering if the plan checker will allow you to build the house of your dreams. You will be able to site the national code and move forward with your construction process, with a permit."

http://www.naturalbuildingblog.com/national-straw-bale-building-code-is-a-go

Post and Beam Hardware



Post and beam frame built with standard wood connectors

Numerous readers have requested advice on the quickest, easiest way to build post and beam frames. I suggest using standard galvanized metal wood connectors by companies such as Simpson Strong-Tie. (I'm referencing Simpson anchors because they're widely available. Shop and compare. All brands meet code.) Deciding which connectors to use can be a bit confusing since there are hundreds to choose from. Post bases on a small porch, for instance, usually don't need to be as securely anchored in the concrete as a house. For a porch, it's usually more important to raise the posts to prevent moisture damage, so a different post base may be used than what is shown here. And to add to the challenge of selecting the right ones, connectors go by different names. Wall bracing may be called sway bracing, a post cap may be called a beam anchor and so on. The drawing above shows a typical example. Other similar connectors could be used, but the ones shown here will get you started in the right direction.

http://www.naturalbuildingblog.com/post-and-beam-hardware

$7.50/sq. ft. Straw Bale Home

Stephen and Nena MacDonald's post and beam strawbale house

Stephen and Nena MacDonald's post and beam strawbale house in Gila, New Mexico that was built in 1988-1989. The initial shell was $5/sq. ft. and the finished cost was between $7-$8/sq. ft. – **Permaculture.org**

"Build our house out of straw?" When our neighbor suggested the idea as a solution to our housing problem, both my wife, Nena, and I reacted similarly. "You must be kidding!" Even when he showed us a copy of Fine Homebuilding with an article in it by Gary Strang (1985) on a studio built out of straw bales, we were dubious. It was just too weird (images of rotting hay, mouse hotels, and pig stories readily came to mind). The idea was too simple and straightforward to be believed.

Try as we might, however, we kept returning to the idea of it. It did seem to fit our condition: Using straw bales was 1) low cost…we were near broke, having used the last of our meager savings to buy a small piece of land; 2) a way to stay cool (and warm)…having just moved to southwest New Mexico from Alaska, I was scared to death of the heat; 3) fast and physically easy to build…I just couldn't face the slow, heavy work of adobe; and 4) ecologically sound…besides being energy efficient, a straw-bale building uses a renewable resource (often viewed as a waste product) that was locally available. Done right, building with straw uses very few trees.
In the end, we decided to go for it. Seven years later, we have no regrets." – **The Last Straw**

Our humble little house in this out-of-the-way, very rural valley, has gotten on the map. For awhile there we had visitors almost daily. We should have put out a guest book for all the far-flung people that have come by to see and ask questions. Folks from all over have stopped by (including one from Japan). And in such diversity. Rich and poor, young and old. Ranchers and farmers. Architects, contractors, and engineers. Househusbands and wives. Young "new agers" just starting out. Conservative retirees. Migrant workers and people working with migrants… Looks like another hot day in the valley. Already it's in the high 90s. During the night we keep the windows open to capture the night's cool. The

mass of our concrete floor helps store it. Thick walls and ceiling keep it in. Inside, the straw bale is holding steady at 75 degrees F. – **The Last Straw**

Steve O. MacDonald's Rules of Thumb
1. Keep it small
2. Keep it simple
3. Build it yourself
4. Stay out of debt
5. Use local materials
6. Be energy conscious
7. Make yourself a home
– **The Last Straw**

http://www.naturalbuildingblog.com/7-50sq-ft-straw-bale-home

Dunne Family Strawbale Update


Dunne family strawbale house under construction — December 2013

The Dunne Family house is progressing nicely. The roof is on and straw bales are up. This is the building system I've been recommending for years. It's especially suitable in cold climates where local wood can be obtained for the post and beam frame and, of course, where there are few building codes.

http://www.naturalbuildingblog.com/dunne-family-strawbale-update

Dunne’s Hardware Stores….NOT!

“Everything from sawmilling his own lumber, to roundwood timberframe, to stones collected on his own land, to strawbale, to building a rocket mass heater, to family participation in construction. Plenty of interesting parts of that project to follow along, and it’s currently under construction. Should be fun to watch this one as it gets finished.”

http://www.naturalbuildingblog.com/dunnes-hardware-stores-not

Strawbale Roundhouses Built in One Day

Strawbale roundhouses like this can be built in as little as one day.

A kindred spirit sent me a memorable letter about 10 years ago. They had read about the strawbale roundhouse I helped build with the Lakota Sioux in South Dakota. (I recently found out the roundhouse later got destroyed in a flood.) For some reason the straw bales on that particular project were very difficult to bend into shape. Normally you can set one end of a bale on a raised object such as a small log, stomp the side of the bale in a few places and end up with a curved bale. Well, these bales would spring right back to their rectangular shape. So we'd stomp them again and again until they 'cooperated'. But the bales would still gradually straighten out somewhat in the wall. We successfully finished the shell of the house on schedule, but I'll never forget those bales.

I was pleasantly surprised to hear from the author of the letter that they build strawbale roundhouses in one day. I never got around to mailing them back for some reason and I've always wanted to connect with them somehow. Maybe they'll see this blog post and write again.

With that background, here's the basic process they use. It's quick and easy to stack bales. They're like pre-made giant building blocks that can be set in place by one person (or two people who are less strong). The tedious part as mentioned above is keeping the bales in alignment (= perfect circle). The author uses ¼" steel cable and turnbuckles on each course of bales. The cable is wrapped around the roundhouse and the ends fastened to each side of the pre-set door buck. The turnbuckle is added in a convenient location and then tightened until the bales are cinched into the desired radius. The turnbuckles are embedded in thick exterior plaster.

http://www.naturalbuildingblog.com/straw-bale-roundhouses-built-in-one-day

Nice modern strawbale yurt at Lynx Basin Ranch.

I decided on the yurt design for practical reasons. Wind resistance, earthquake proof, extremely easy to heat (or keep cool), and damn cheap ($150 counting the four used windows for $50). The materials are gotten right here except for nails and glass. In my business, the less effort you gotta spend staying alive (it gets to -70 degrees) the more you can spend keeping your animals alive and, therefore, making payments. Simple, huh?”

http://www.naturalbuildingblog.com/straw-bale-yurt-bible

Other Building Methods

Grain Bin Homes

Sukup SafeT Home galvanized steel manufactured home

The most interesting thing about this product is it has already been designed and fabricated as a home. Some people have converted grain bins into homes by cutting door and window openings, etc. You can even buy plans for grain bin homes. But this is the first company to my knowledge that offers a complete home building kit that's ready for assembly. This particular model sells for $5,700. It can be easily assembled with a few hand tools, although I would definitely use a cordless drill. And yes, it's made with steel, an energy intensive material, but the extra environmental toll may be justified, for instance, where hurricanes and tornadoes routinely wreck havoc. Its virtually maintenance free 70-year life span is certainly a big plus. I'm impressed with the double, continuously vented roof that prevents overheating. So this design has some good features going for it. It would benefit from insulation. Some might find it practical as safe, temporary shelter while their permanent home is being built or as a cabin or storage building. I wonder if they sell the roof separately so it can be used on an earthbag roundouse?

http://www.naturalbuildingblog.com/grain-bin-homes

Grain Bin Homes 2

Sized Just Right Grain Bin Home

There are many clever ways to use steel grain bins as parts of homes, and the above picture shows just one possibility. It was designed by Mark Clipsham, who has specialized in developing grain bin concepts. You can see many other of his designs at www.dreamgreenhomes.com.

The advantages to using these bins as modular components in building include: they can be assembled rather quickly; they can be extremely well insulated if one is nested within another and the space between them is insulated; they are very durable, lasting perhaps a century without maintenance; the steel itself often includes recycled content; they are fireproof, wind resistant and earthquake proof; and they can be fairly economical.

http://www.naturalbuildingblog.com/grain-bin-homes-2

More Grain Bin Homes

Nice grain bin house with wrap-around porch

This blog post has photos of six grain bin homes.

http://www.naturalbuildingblog.com/more-grain-bin-homes

Earth Shelter Reinforced Quonset Buildings

Quonset building with interior wood framing

Steel quonset structures or 'culvert homes' are usually not rated for underground

residential use. From what I've heard, most quonset hut manufacturers will not sell to anyone who intends to bury the structure. Covering a building with earth adds enormous weight on the structure and manufacturers don't want any liability issues in case of collapse. This is unfortunate because quonset structures are well suited for underground homes, rootcellars and storm shelters. For one, they're quick and easy to build. The main step involved is bolting the arched sections together with cordless drills.

If you're interested in building something like this, I suggest finding the strongest quonset you can find and then consult with an engineer on the loads it can carry. There's a good chance additional reinforcement will be recommended. Offhand, I can think of four general ways of reinforcing quonset structures for underground use.

1. Put concrete reinforcing mesh (remesh) and concrete on the outside. This method is fairly common and may be the easiest approach for most do-it-yourselfer owner-builders.
2. Add mesh and spray shotcrete on the inside of the quonset.

The next two options will likely require supports perpendicular to the beams or trusses. Hire an engineer to do the necessary structural design.

3. Interior wood framing (see photo above). Wood is easier for owner-builders to work with than concrete and steel, and so this option has good potential for those seeking to bury or add earth-sheltering on their quonset structure. Wood framing also makes it easier to add plumbing, electrical, insulation and finish the interior (paneling, sheetrock, etc.).
4. Weld custom trusses with girders on top to reinforce the structure. This would get expensive unless you do your own welding and have access to affordable materials. Some quonset manufacturers may sell trusses and girders for this purpose. Most likely you'd have to either do the work yourself or buy from a local shop.

Note: If you can't find thick steel quonsets that are strong enough for burial and don't want to use the other options listed above, then consider buying concrete culvert pipe.

Also consider orienting a quonset so it's long axis is east/west. Add a greenhouse on the south side (in the northern hemisphere) so the home is bathed in sunlight and warmth.

Another option is to join quonsets side by side with south facing window walls to maximize solar gain.

http://www.naturalbuildingblog.com/earth-sheltered-reinforced-quonset-buildings

Star Top CEB Presses

Star Top compressed earth block presses

Compressed earth blocks (CEBs) have countless uses and come in dozens of shapes (many more than shown here). They are commonly used for residential and commercial structures, earthquake resistant structures, privacy walls, columns, bond beams, pavers, planters, stairs, etc. For instance, you could make CEB columns on your house and privacy walls and stack earthbags between. (See **Confined Earthbag**.) Right now I'm making an outdoor oven with CEBs. The possibilities are endless.

Star Top Construction and Blockprasan Co., Ltd. manufactures very high quality compressed earth block presses in Nakhon Pathom, Thailand. When you look at the ¾" (2 cm) thick steel parts, it sure looks like these machines would last well over 100 years with continual use. Note: I am not paid in any way for promoting these presses. I'm very impressed with their ruggedness and quality and would like people to know about their products. In fact, I've admired them for about 4-5 years and have finally got around to telling people about them.

Many people know about the **Aureka** presses made in India. Here's a brief comparison:
Star Top Standard press makes 10 types of blocks and costs $800 US.
Star Top Hitop press makes 30 types of blocks and costs $900 US.
Aureka 3000 multi-mould manual earth block press is roughly twice the cost if I remember correctly.

Star Top also manufactures a whole line of block making equipment, including hammermills to pulverize soil, mortar mixers to mix the soil with cement, and machine and hand-operated block presses. I'm guessing there are several thousand small shops in Thailand with a similar set of machines. They quoted us $4,171 for the whole set of

machines to make blocks by hand and $8,843 for the machine operated set that makes two blocks at a time.

Sample CEB Block Shapes (many more available)

Note the holes in the CEBs. Rebar is inserted through the blocks and then the holes are filled with cement grout. There is no mortar between this type of CEB.

http://www.naturalbuildingblog.com/star-top-ceb-presses

Unusual Compressed Earth Blocks (CEBs)

CEBs made of ground laterite stone have a very striking color

Most compressed earth blocks (CEBs) are made in a mechanical press with a mixture of sandy soil, clayey soil, and a small amount of cement and water. CEBs typically require no plaster and are popular for walls, privacy walls, planters and much more. We used CEBs on our **outdoor kitchen** and **raised garden beds**. Recently I've discovered some rather unusual and very interesting CEBs made with unconventional materials. In addition to the compressed blocks shown here, you could use crushed glass, lava rock, brightly colored soil

in sediment-like layers, sea shells, crushed limestone and other low cost and sustainable materials. The main idea is to utilize what is affordable and locally available.

Laterite blocks
Laterite stone is ground, sieved, mixed with 5% cement and a setting agent, and pressed into blocks (mortarless interlocking blocks in thise case). I love the color.

Laterite blocks are specialty blocks and probably more expensive than conventionally CEBs. This could be an option for those who can afford it. They should be very durable and rainwater resistant since soft laterite turns as hard as brick when exposed to air.

CEBs made with fly ash
Fly ash is an industrial waste product, a residue of coal based power plants. Fly ash is often added to concrete to reduce the use of cement. Fly ash can also be compressed into strong, durable blocks. The stark gray color can be easily improved by adding natural mineral pigments such as iron oxide.

CEBs made with sandstone chips
This house by Deepak Godhi in Bangalore, India uses CEBs made with sandstone chips. The rough stone texture is particularly appealing. The rough exposed aggregate surface may be created with a pressure washer. Columns like these are often made with hollow CEBs to make room for rebar and concrete reinforcement.

http://www.naturalbuildingblog.com/unusual-compressed-earth-blocks-cebs

1,000 Year-Old Straw/Clay Houses in Germany

Classic German architecture: Fachwerk und Enxaimel — Timber-frame straw/clay houses with hazel stick reinforcing lasts for centuries. (None of these buildings had building permits and so maybe they should all be pulled down?)

A beligerant drunk in a restaurant overheard me talking about natural houses. He confidently proclaimed houses built of natural materials would never be allowed in a modern country such as Germany. "The codes would never allow this," he said assuredly. I explained how straw/clay houses have a centuries long tradition there, and that strawbale structures are now permitted. There's even a strawbale building association in Germany (**FASBA**).

From the FASBA website (translated): "To date, over 250 approved homes and some production buildings and many smaller demonstration buildings have emerged. The attainment of an admission by the general building materials FASBA 2007, this construction is gaining in approval, as there is no difficulty in most cases to obtain a building permit." A five-story strawbale structure was recently completed. "The North German Centre for Sustainable Construction has received the Innovation Award 2013."

http://www.naturalbuildingblog.com/1000-year-old-strawclay-houses-in-germany

Light Straw-Clay Construction Now Code Approved

Light straw-clay construction is in the 2015 International Residential Code

"An appendix on Light Straw-Clay Construction was also approved for inclusion in the 2015 International Residential Code (IRC). To date only the states of New Mexico and Oregon have a section on Light Straw-Clay Construction in their building code. The proposal received a 6-3 approval vote at Building Committee Hearings in Dallas in April 2013. After public testimony and immediately before the vote, one committee member encouraged approval, commenting, "This is the future."

The appendix governs the use of light straw-clay "as a non-bearing building material and wall infill system". It is limited to one-story structures, except it allows structures greater than one-story "in accordance with an approved design by a registered design professional." It is also limited to use in Seismic Design Categories A and B, but this includes approximately 85% of the contiguous United States. Use in higher seismic risk categories can occur through the "alternative means and methods" section of the code with an engineered design."

http://www.naturalbuildingblog.com/light-straw-clay-construction-now-code-approved

Straw/Clay Houses

Weaver-Hovemann timberframe and straw/clay home by EcoNest

Straw/clay has been in use for thousands of years with great success. The focus of our blog is obviously earthbag building, but we've decided to include coverage of other natural building methods to broaden our horizons and reach a wider audience. It's good to know a whole range of building ideas so you can obtain the best possible house. For instance, maybe you want to use earthbags on exterior walls and straw/clay on interior walls. This is a very good option that requires no formwork. You could stuff straw/clay inside pallet walls for soundproofing between rooms. Most often straw/clay is combined with a timberframe that carries the loads.

"One of the best low-cost insulating materials is clay-coated straw (or other lightweight plant materials). A light coating of clay acts as both a binder and preservative. Clay-coated straw has been shown to last over 700 years as a non-deteriorating insulation! As the clay dries, it binds the straw together in a surprisingly rigid mass. It's a "natural styrofoam".

Materials
Any stiff agricultural waste similar to straw will work. Hay is too flimsy and has seeds, so it doesn't work very well. Barley straw, wheat straw, and other grain straws work well. Clay can be gotten from the earth. Many subsoils are primarily clay. River bottoms and river banks are usually clay. Clay is also used by brick and tile manufacturers and can be bought from them cheaply. (in our area, about $16 per ton)

Even soil which has a moderate amount of clay such as commonly used for adobe, about 35-50% clay, will work. The slurry is not as sticky, compared with pure clay, but even ordinary mud works well enough. This is not rocket science. Use a dry wall stirring paddle and electric drill to mix the clay or mix in any kind of mixer. Mud mixed in a box with a hoe works.

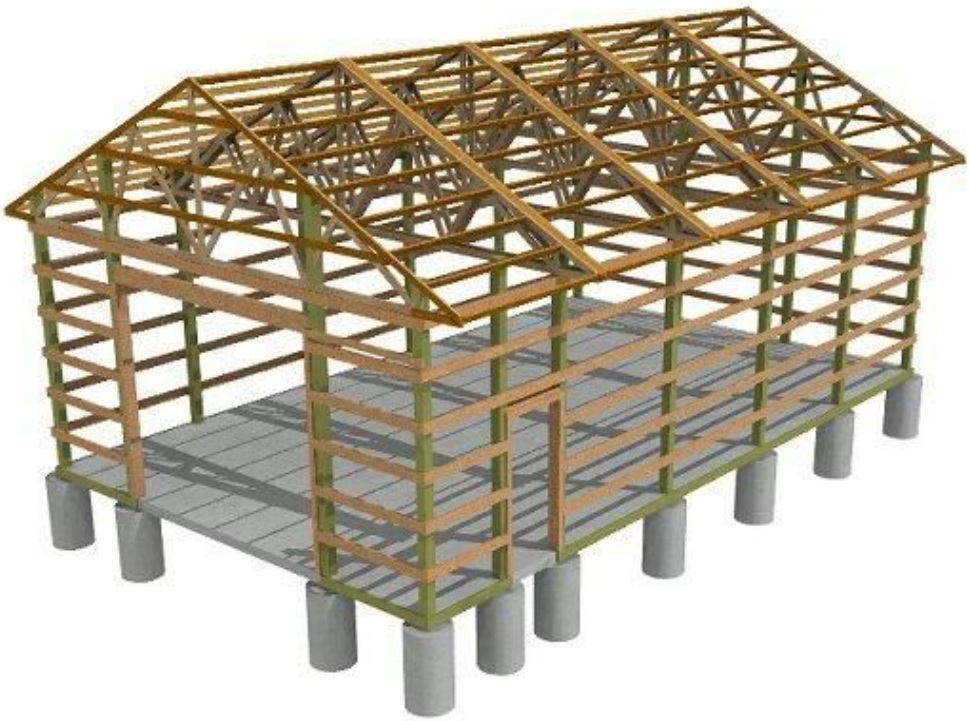
Method
1. Break the clay into small particles so that it will mix with water easily.
2. Make up a slurry of clay and water. Any soil that is mostly clay will also work. The consistency should be like cream or a thin milk shake.
3. Spread the straw out on the ground. Dampen the straw with a spray nozzle if available.
4. Pour (drizzle) the slurry over the straw, then toss and mix the straw so that it becomes lightly coated. Ordinary garden rakes work well. The clay should only very lightly coat the straw. This is NOT adobe. Maybe 5-10% clay, 90-95% straw. When dried in the wall, you can hardly see the clay, but it binds the straw together very well.

Uses
In addition to being an insulator, it can be used as a wall forming material. In the middle ages, even up to the present time, the method works like this:

1. A post and beam structure is first built.
2. Two boards are temporarily nailed to the posts, one on each side.
3. The resulting cavity is filled with straw-clay.
4. The material is tamped down (a 2×4, 4×4, or small post will do). The idea is not to compact it into a solid mass, you couldn't do it easily anyway because the straw will remain springy until it dries.
5. The two side boards are moved up immediately and stuffed again and again until the wall is as high as desired. No need to wait for the straw-clay to dry before moving the boards up. (A moveable, sliding form could also be used to make walls.)
6. A saw is used to cut out windows, or window frames are placed first.
7. The wall is allowed to dry and is hand plastered inside and out. The soft undulating plastering adds a charm that cannot be found in modern buildings."

http://www.naturalbuildingblog.com/strawclay-houses

Pole Building



There are many advantages to pole building, including speed, ease and lower cost of construction.

Here are a few facts gleaned from Low Cost Pole Building Construction, by Ralph Wolfe and Practical Pole Building Construction, by Leigh Seddon.
– Adaptable to steep terrain, rocky soils, marshes, beaches, earthquake and hurricane zones. For instance, you can save a lot of money by building on low cost hillsides.
– Meets building codes and FHA requirements.
– Poles serve as foundation, structural frame and wind bracing.
– Building with poles saves labor, time and materials. For instance, you can typically save thousands of dollars in comparison to building a concrete foundation.
– Total cost is often 15%-25% lower than standard construction or about half the cost of a contractor-built house.
– Roof can be built before the walls.
– Round or square poles can be used, although round poles of the same size are 18% stronger.
– Poles are more fire resistant than stick frame houses.

http://www.naturalbuildingblog.com/pole-building

Small Diameter Roundwood – An Underused Building Material

Many of those in need of housing have access to small-diameter trees in nearby forests. These trees can be used to produce materials that are ideal for building affordable homes. If used in conjunction with energy-efficient straw bale construction and other natural materials, small-diameter wood can be used to create a better home than most building systems, at lower cost.

US forests have been poorly managed and are now choked with small-diameter trees. Thinning these trees to reduce the risk of forest fires, which is currently at a record high, is a Forest Service priority. With an inexpensive firewood permit, anyone can obtain small-diameter wood for building a home. (Even though this wood could be used for firewood, it is more valuable as a building material.)

There are several advantages to using small-diameter wood for building:
– Small-diameter wood can provide all of the lumber for a house including studs, joists, plates, trusses, window and door frames, trim, and other components. Wood frame construction is the preferred building system in the US because of its speed and ease of construction, but unfortunately most dimensional lumber is not sustainably harvested. Using small-diameter wood encompasses the advantages of wood frame construction but uses wood that improves the health of the forest and reduces forest fires.
– The use of locally available wood reduces construction costs and avoids supporting environmentally irresponsible lumber companies.
– Wood in the round is much stronger than standard dimension lumber and requires less processing. Thus small diameter logs can be used, with fewer parts. For example only one-half as many trusses may be required, because pole trusses can be set every 48 inches (122 centimeters) instead of every 24 inches (61 centimeters).
– A US$40 chainsaw guide can be used to mill purlins, joists, studs, plates, and other components. (The Beam Machine is one example of a low-cost chainsaw attachment that can mill straight edges on poles.)

– The fire resistance of poles is much higher than stick-framed trusses or engineered trusses (TJIs). Wood poles have a two-hour commercial fire rating, in contrast to the other two options, which have a one-hour fire rating. And in the event of a fire, there is no toxic off-gassing – the leading killer in home fires.
– Timber frame/pole construction is more aesthetically pleasing than wood frame construction covered with plasterboard. The beauty of the wood is left exposed, honoring the tree from which it came.
– Very few tools are required to build simple pole trusses. If they are built in uniform sizes, workers can be trained to build them quickly.

The use of small-diameter wood creates local jobs and places less reliance on highly processed materials that must be shipped long distances. Jobs are created in four categories:
1. Logging: Workers are needed to cut, mill and deliver poles.
2. Truss manufacturing: Workers are needed to build roof trusses. This could be a cooperative effort or an entrepreneurial cottage industry. Either way the quality will be higher and more consistent if specially trained workers build the trusses.
3. Milling: Workers are needed to mill logs into purlins, studs, plates, or joists. The simplest method uses a chainsaw and a guide. Mass production methods with commercial-sized equipment are even faster and more efficient.
4. Construction: Workers are needed to erect trusses, build walls, etc.

With all the advantages of small-diameter wood, we should take a closer look at how to use this resource that is so often near at hand.

http://www.naturalbuildingblog.com/small-diameter-wood-underused-building-material

Bandsaw Sawmill

Almost every home uses at least some wood. We've been examining various free and low cost ways of obtaining wood for homebuilding. Yesterday's blog post mentioned cutting

your own wood with a bandsaw sawmill. Again, this is a great way to mill wood for far less expense than store bought lumber. There's lots of free info about this topic on the Internet. A number of companies such as Wood-Mizer sell bandsaw sawmills. You can also make your own. (Obviously a hot topic on YouTube.) This video shows a homemade mill made for about $500 using mostly salvaged parts.

One interesting option is using a portable bandsaw mill. This enables you to take the mill to the logs instead of moving them. You still have to lever the logs around with a peavey, but it's less work than transporting full size logs. It doesn't have to be all work. You could turn the experience into a fun outing in the woods.

http://www.naturalbuildingblog.com/bandsaw-sawmill

Pallet Houses

Pallet home by Texas Natural Builders

Pallet building is a hot topic and so the next few blog posts will explore various aspects of building with pallets — from entire houses, to interior pallet walls, to pallet wall cladding. Over 4 billion pallets are currently in use, so this is an abundant, easily obtained and usually free resource. Excerpts below about pallet building by David Reed of **Texas Natural Building**, a pallet house expert.

"I have been building residential homes for 24 years, I know structural stability inside and out, the strength of a pallet home is comparable to that of a conventionally framed home. In the smaller homes we design we have found that a staggered brick like installation is not needed and we try our best to find pallets exact or as close as possible in size, the installation process is as follows:

Once we decide on the foundation type, typically we always try to keep concrete forms out of our choices, we secure scrap 2×4 cleat blocks to the foundation, set back about 1/2″ -5/8″ , then slip the pallets over the blocks and secure them with screws horizontally into the cleats, toe screw the 2×4 frame of the pallet into the foundation as we level each one. We clamp each pallet together with C -clamps and fasten together with screws and sometimes carriage bolts, we butt corners with lapping pallets ends, and repeat this process as a soldier course along the perimeter of the foundation.

The top of the first course of pallets gets a continual 2×4 plate that is screwed down into the tops of the 2×4 frame of the pallets, this allows the pallets to be force straightened and gives it some pretty powerful rigidity!! We then install the second course of pallet just like the first, windows and doors are framed either as bucks or conventional trimmers and headers. A 2×4 top plate is installed on top of the second course and marks for joists and rafters which are installed conventionally.

In larger homes, we have found that we do have to stagger the pallets in long runs or insert a vertical 2×4 every 8′ for lateral strength. We cut pallets to fit re-using all of the materials as much as possible. We have other plate installation methods of installed on a earthbag stem wall or a cob or strawbale stem wall as well as rock using box beams as base plate and top plate with a 2×8 as the center horizontal plate. Once the pallet walls are up to the 8′ height then I come back measure and mark for the windows and then cut the opening out, frame it and pop them in!!

There are two types of wooden pallets made, HT (heat treated) and MB (Methyl-Bromide), we only use heat treated pallets in our designs and builds.

We use all natural materials as insulation, in this case being **light straw clay** which has an insulation value of about 1.5 per inch. We then add an **adobe plaster** (earth plaster) on the interior and exterior of the structure, this is typically local materials sources right from the build site! This provides both insulation and thermal mass!"

http://www.naturalbuildingblog.com/pallet-houses

Rex's House

So what happened to Rex? How did his pallet house turn out? I'd sure like to know. When people send us owner-builder home projects that cost $4/square foot then obviously tons of people will be interested. Most likely Rex's house is finished and he's moved on to other things. If Rex happens to see this, please please email me an update of your house.

Here's how the story began:
A while back I got an email from Rex, a reader who's planning an ultra-low cost home in Texas. We exchanged a few emails and each time he would ask if it's possible to further reduce the cost. He said "Owen, I have pallets, cedar poles from my land and dirt." His persistence in lowering costs had me racking my brain for cost cutting ideas. Rex's original plan was to build an earth lodge. Now he's planning a rectangular design that he thinks will be simpler and easier to build. The latest cost estimate for his 800 sq. ft. earth-bermed house design is around $1,600. That's only $2/sq. ft.! Time will tell if he can actually build at that cost.

Very few people are able to build nice, decent sized homes at $2-$4/square foot. Viable solutions could help countless thousands of people. For these reasons Rex's house naturally attracted lots of attention and comments, and inspired me to write related stories like this one on **rot resistant juniper and cedar poles for construction**.

So Rex – or anyone who knows how to contact him – please send us an update with photos! If he doesn't respond for some reason, maybe another reader can build something similar and publicly document their project so these ideas get utilized by more people.

http://www.naturalbuildingblog.com/whatever-happened-to-rexs-pallet-house

Passive Cooling Strategies for Hot Climates

Today I want to talk about passive cooling strategies for keeping your home cool in hot climates. This is a very hot climate and yet our earthbag roundhouse is about 15 degrees Fahrenheit cooler inside than out. So 15 degrees Fahrenheit, 8 degrees Celsius temperature difference with no mechanical cooling systems. No air conditioners, no fans, no anything. It's just passive strategies, natural strategies for keeping the home cool without the use of machinery or electricity. So we'll discuss about 11 different strategies that you can use. They're all very low cost and simple.

The first one is the color of your wall — your exterior wall. You want the walls to have a light color so they reflect sunlight. One of the most important things is to have wide roof overhangs. This is about 4 feet, a little over one meter. So the sun almost never hits the wall. Because they're high mass walls, if the sun hit the walls frequently, that mass would heat up and eventually that heat would transfer inside. So we keep the sun off the walls as much as possible.

Another important strategy is windows. We have casement windows that swing open and catch the prevailing breezes. So the breezes come from this way and these are like a scoop — a wind scoop — to pull the wind into the roundhouse. We also have windows on all sides of the house so the breeze is always blowing through.

If you look up above the window, we have screened openings above the windows that keep insects out, but let hot air escape this way. I don't know if you can see it, you might want to come closer. Above the bond beam is a gap of a few inches. In between the rafters there's a gap where hot air can escape. So the hot air is rising and it goes out the top. Also

we use thatch roofing and some air passes through the thatch. We also have one of these screened openings above the door as a transom.

Let's go inside and I'll show you the earth coupled floor. This is our earth coupled floor right here. What that means is the floor — the high mass floor — in this case concrete, but it could be tamped earth, stone, CEBs, brick, recycled brick, whatever. The floor is in direct contact with the earth underneath with a moisture barrier to prevent wicking of moisture. So the floor is absorbing the coolness of the earth. It's very cool, surprisingly cool even in this hot climate where you can start sweating in just a few minutes. So this is surprisingly cool. We also have earthen plaster on the inside. All that mass and this mass partition wall [and earthbags] all absorb the coolness of the earth — the coolness coming up from the earth. And the breezes help all the hot air escape. So the temperature inside stays the same night and day. You don't need an air conditioner or even a fan. It's surprisingly comfortable in here.

Some other strategies — you want to look up and see the high ceiling, so there's plenty of space for hot air to rise and escape. There you can see the gap above the bond beam to improve ventilation.

The last strategy I'm going to talk about is vegetation — using plants to keep the building cool. Here we've used a mango tree on the hot southwest side of the house. That's the hottest direction. We have different plants here. So the sun, as you can see, almost never hits the house directly. And also we have a very large tree above here that protects and shades the house through most of the day. Again, these are all simple, low cost strategies that anyone can do. Very low cost, very simple. You can save a lot of money on energy bills and also help the environment.

http://www.naturalbuildingblog.com/passive-cooling-strategies-for-hot-climates

Additional Passive Cooling Strategies for Hot Climates

The following list includes dozens of low tech, low cost ways to cool buildings in hot climates passively without electricity or machinery, i.e., passive cooling or natural cooling. This list is in addition to the 11 or so simple passive cooling techniques that I talked about in **my video the other day**. Altogether there are over 50 practical methods for cooling your home sustainably. Despite all these wonderful methods, most people – at least in North America – live in poorly insulated boxy houses with costly, wasteful air conditioners. This is one example of "ignorance is not bliss".

– night cooling: open the windows at night to let in cooler, fresher air.
– roof vents for improved ventilation. This could include a ridge vent and cupola.
– gable vents on gable end walls
– adequately shaded clerestory windows
– smaller windows on the east and west to prevent overheating (if the walls aren't shaded)
– louvers and vents
– well located doors
– 50-100% more or larger windows on the leeward side than the windward side to help hot air to escape
– earth berming with moist vegetation such as grass
– keeping vegetation moist around the house to help cool the breezes (the yard)
– planting trees to funnel air toward your house
– plant trees that don't block breezes
– wing wall to direct cool breezes into the home
– building on stilts
– stack effect: multi-story designs can be very effective at encouraging natural convection
– open plan living areas that encourage air circulation
– narrow floorplans
– orientation to catch breezes more effectively
– location: breezy locations near lakes, etc.
– outdoor living areas
– porches/verandas that shade the walls
– shaded, high thermal mass walls such as earthbags, adobe, etc.
– windscoop/windcatcher (with possible addition of a water element)
– evaporative cool wall such as double terra-cotta brick walls (**low fired brick**) filled with moist sand
– **Venturi effect**
– solar chimney: chimney designed to heat air and draw air from the house
– atrium or sunroom: can act like a solar chimney if properly designed
– basement: upper floors draw cool air upwards from the basement
– cool pantry and rootcellar
– well, open air cistern or underground water canal in the basement
– earth tubes in dry climates where mold is not a problem and digging is fairly easy
– roof insulation and reflective roof insulation
– fly roof (secondary roof over the main roof)
– green roof/living roof
– soffit vents and baffles between rafters to improve roof ventilation

– light roof color that reflects sunlight
– manmade water feature such as a lily pond on the windward side
– awnings (if you don't have large roof overhangs)
– inner courtyard/open atrium
– pergolas and trellises to shade walls
– minimize sun reflection and re-radiation from surrounding environment: plants versus gravel or pavement
– blinds: close if sunlight is entering window
– avoid skylights unless openable and tinted
– smooth plaster reflects more light than textured plaster

Note: This is just a list of practical cooling strategies. There are plenty of 'yeah, buts' you should be aware of to prevent problems. There isn't time or space here to cover everything. A fair amount of research is required to learn the details so you can optimize the passive cooling design for your home and building site.

http://www.naturalbuildingblog.com/additional-passive-cooling-strategies-for-hot-climates

Log End Flooring

Heart pine log end flooring

I've assembled some of the best photos I could find on log end flooring. This type of flooring is made with end grain (with the wood grain oriented vertically). Log end or end grain flooring has been used for centuries in palaces, luxury homes and high traffic areas because of its beauty and durability. End grain is harder than long grain (horizontal grain) and that's why it is used on professional quality chopping blocks and top quality flooring.

"Residential real estate agents say homes with wood floors hold their value better, sell faster, and fetch higher prices, according to a recent nationwide survey commissioned by the National Wood Flooring Association (NWFA). By a three-to-one margin, real estate agents said that a house with wood floors would sell faster than a carpeted house. Some

58 percent said a house with wood floors would bring a higher price. Health benefits are also a factor for those considering hardwood flooring. Whereas carpets over the years gather mildew, mites, animal dander, dust and pollen beneath the surface that can cause respiratory problems and aggravate allergies, hardwood flooring has a very durable surface that is easy to clean and maintain. Properly maintained hardwood floors are extremely resistant to mildew and the other ails of carpets. Hardwood and laminated wood floors are the smart and healthy choice.

Hardwood flooring is always made up of a real hardwood surface, whether it's solid or engineered hardwood. The result is a natural, real hardwood floor that can be resanded, stained, and varnished to match your tastes and changes in your decor. If it's well cared for, it will last nearly forever. A solid hardwood floor can be sanded and refinished several times over many, many years."

http://www.naturalbuildingblog.com/log-end-flooring

Small Wood Stoves for Small Homes

Andrew, one of our readers, suggested a blog post about small stoves for all those planning small earthbag homes. This is a great idea because earthbag buildings are highly efficient and so in many cases all you need is a small stove. The emphasis here is on small, low cost, do-it-yourself wood stoves that are fairly easy to make. Making the stoves yourself can save you $200-$300 or so. Buying used or a kit are other good options. These small stoves go by various names, including tent stoves, outfitter stoves, shepherd stoves, barrel stoves, homemade wood stoves and so on. The following stoves include military surplus stoves and stoves made from drums, propane tanks, water heater and compressor tanks, beer kegs and ammo boxes.

If you're serious about building a stove like this, it will pay to watch lots of videos, because there are lots of ways of making things – some better than others. You can mix and match features and get a stove that's just right for your needs. Consider adding a cooktop surface and **hot water jacket** (water heating coil). If your welding skills aren't up to the task or you don't have the necessary equipment, barter or trade work with a local welder to keep the money in your community. The following list contains some of the best videos from a variety of types.

Army surplus and ammo box stoves

M1941 tent stove
Army Surplus Hunter SHA (Space Heater Arctic)
Homemade Ammo Box Woodburner Stove
Ammo box wood stove 3 FINAL
DIY wood stove from a surplus ammo can

Gas bottle stoves

Luke's stove made with a gas bottle homemade wood burning stove
Recycled gas bottle log burning stove part 3
Gas bottle log burning stove
Wood Burning Grover Stove

Homemade Wood Stove a.k.a. "Piglet"
Homemade wood burning stove
Wood burning stove with water heater from gas bottle
Home made gas bottle wood burning stove
Cylinder hunt tent stove
Cylinder Stoves Hunter Stove Package Wood Burning Tent Stove

Barrel or drum stoves
Double barrel stove
Winter solo hot tenting
DIY Hunter Tent Stove woodburner #3
Barrel wood stove update
Build Your Own Woodstove For $100
Survival stove
55 gallon wood stove barrel
Barrel Stove Kits

Stoves from hot water tanks
Wood Stove From A Hot Water Heater
How to build a wood stove from old hot water tank
Wood stove from hot water cylinder
Water Heater Wood Stove

Stove from compressor tanks, beer kegs, scrap steel
Air Compressor Tank Wood Stove – The Finale
Beer keg wood stove
Homemade wood burning stove
SHTF Box Wood Stove

Rocket stoves (hugely popular, do a search on YouTube)
DRTV: Rocket Stoves

Stoves for sale
Shepherd stoves
Outfitter stove
Wood burning stove woodburner coal gas bottle stove
Cylinder Stoves Hunter Stove Package Wood Burning Tent Stove

http://www.naturalbuildingblog.com/small-wood-stoves-for-small-homes

Free Heat for Your Home: Homemade Briquettes and Logs

Many people don't have easy access to firewood or the tools and ability to cut, split, haul and stack it. Buying firewood may be out of your budget. Here we'll present some virtually free ways of making fuel briquettes and logs at home with simple devices. To make briquettes/pellets/bricks/logs, you can use free materials such as newspapers, junk mail, cardboard, wood chips, wood shavings, sawdust, leaves, pine needles, manure, rice hulls, straw, corn stover and other biomass fibers. The basic process usually involves soaking the materials and then compacting them with a press into blocks.

Actually, there are quite a few different techniques as you'll see in these selected videos. For instance, some people roll newspapers into logs, thus eliminating the soaking, pressing and drying process. Logs like this can be used right away. Not everyone agrees, however. Some say the logs burn best when rolled tightly, soaked and then dried. Apparently the soaking/wetting process melds the log into a coherent mass. (The log roller shown below wets the newspapers as they're rolled together.)

How to make newspaper logs

Making newspaper fire logs another method

It's fun to watch numerous videos to see what's most practical. Making briquettes and logs is a great family project that everyone can help with. In some countries, making briquettes is a small home-based business.

Sample briquettes from around the world (note the center hole to improve combustion)

http://www.naturalbuildingblog.com/free-heat-for-your-home-homemade-briquettes-and-logs

House Plans

Top 10 Most Popular House Plans by Owen Geiger

Roundhouse/Dome Cluster

Most of you know about my **Earthbag House Plans** site, now with over 120 designs, but most readers are not aware which plans are most popular. Here's the list… [drum roll…]

1. **Roundhouse/Dome Cluster**
2. **Earthbag Survival Shelter**
3. **33' (10m) Roundhouse: 2 bedroom**
4. **Pod Houses**
5. **Enviro Dome**
6. **Enviro Dome 2**
7. **Roundhouse Cluster**
8. **Spiral Dome Magic 1&2**
9. **Hobbit House**
10. **Peace Dome**

All orders from **DreamGreenHomes.com** include a free copy of my **Earthbag Building Guide**.

http://www.naturalbuildingblog.com/top-10-earthbag-house-plans-by-owen-geiger

Free Plans

Craftsman House

Owen received an Honorable Mention in Shelters for All housing competition for this design.

See more free plans here:
http://www.naturalbuildingblog.com/house-plans/free-house-plans

Earth-Sheltered / Underground House Plans

Earthbag Earth Lodge

Based on ancient Native American designs, this earth lodge with living roof will keep you cozy and warm even in the harshest climates, because it is earth-sheltered. South-facing windows and a skylight over the kitchen ensures ample daylighting.

See the other earth-bermed and earth shelters plans here:
http://www.naturalbuildingblog.com/earth-sheltered-underground-house-plans

Straight Wall Houses

Beachcomber House

This Beachcomber House is perfect for most large families. It has spacious bedrooms with computer desks, a large modern kitchen and wood stove. The master bedroom features a walk-in closet and private bath, and is opposite from other bedrooms for privacy.

See the other straight wall house plans here:
http://www.naturalbuildingblog.com/straight-wall-houses

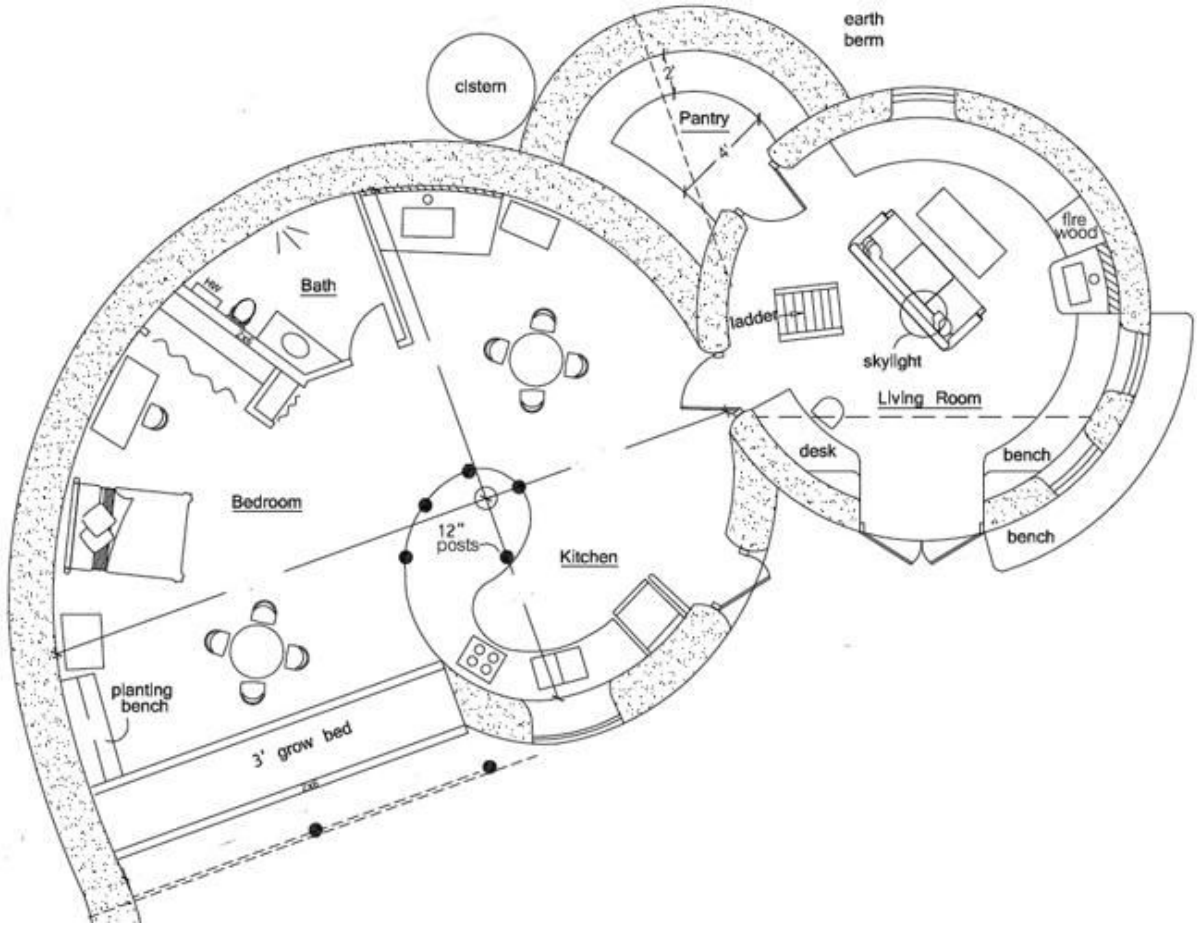
Spiral Dome Magic 1 and 2

South elevation

This highly unique home combines the Peace Dome and Spiral Houses, which are also available separately. But by combining them it really creates a truly exciting design. This unique, almost Hobbit-like earth-sheltered design includes a large grow bed, exposed timber ceiling and living roof. Ample light is provided by the window wall next to the grow bed, window and door glazing, and suntubes. Distinguishing features include two bedrooms, masonry two-way fireplace, covered porch and cool pantry for storage of food (no electricity required for refrigeration). This home meets zero energy standards.

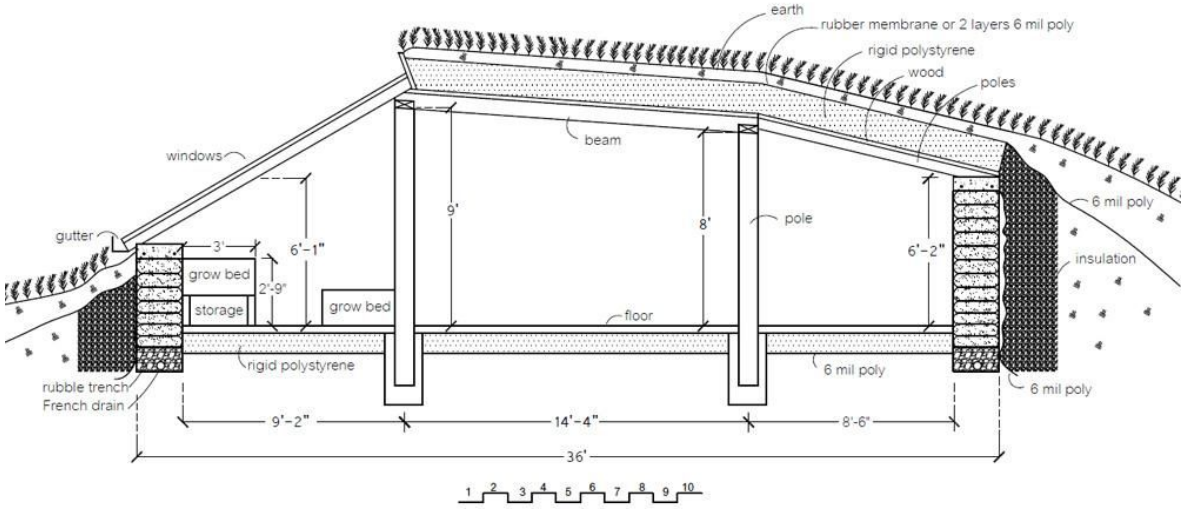
...cont'd

452 sq. ft. interior dome, 740 sq. ft. interior spiral, plus pantry, 2 bedroom, 1 bath; footprint: 42′ x 57′ plus buttresses.



Floor Plan for Spiral Dome Magic 1

http://www.naturalbuildingblog.com/spiral-dome-magic-1-and-2



Solar Pit House section view

Specifications: 1,127 sq. ft. interior living space, 441 sq. ft. interior greenhouse, total = 1,568 sq. ft. interior, Footprint: 36'x53'

As explained in the previous blog post, this modern solar pit house is based on the traditional pit house. The construction is much the same. Additional 'modules' have been added to create an elongated rectangular design for added living space and windows added on the south for solar gain. Each module is based on wood posts set in geopolymer or concrete footings. Wood beams approximately 10"-12" diameter are joined at the posts with half lap joints and pinned in place with rebar or logging spikes. Smaller poles around the perimeter lean against the beams. 24" wide earthbag walls with a reinforced geopolymer or concrete bond beam rest on rubble trench foundations.

The entire structure is surrounded by insulation and moisture barriers, both of which can be obtained as recycled materials. The Solar Canadian [their blog is currently unavailable for some reason] reported that farmers use large plastic bags for storing grain for one year and then discard them. They should make a perfect moisture barrier. And, as discussed in a previous blog post, **recycled polystyrene** is available. In this design, loose polystyrene is used around the perimeter, and home-made rigid board insulation is used on the roof and under the floors. Be sure to test the rigid board insulation so it doesn't compress and cause cracking in the slab floor.

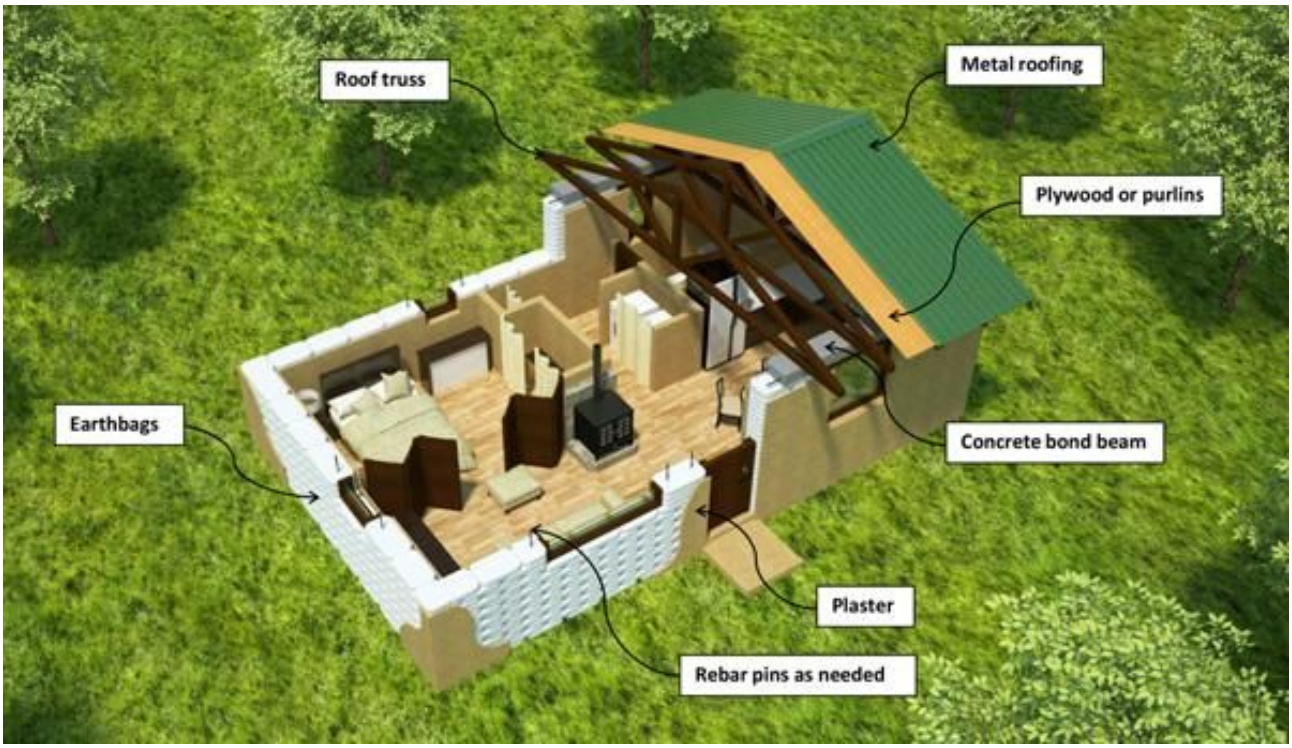
Other features:
– Sloping, earth-sheltered design has no vertical walls exposed to the harsh wind. This greatly reduces heating cost.
– Radiant floor heating is the recommended heating system. At least one back-up heating system is called for due to the extreme climate – either a wood stove or propane heater.
– A window wall separates the greenhouse from the main living space. Solar powered, heat activated fans blow heat from the greenhouse into the home, and cold air return vents draw cool air back into the greenhouse.
– Double door airlock reduces heat loss.

– The entry or mud room has space for coats, boots, shovels, snowshoes and greenhouse window insulation (possibly more polystyrene panels).
– The entry vault helps block westerly winds and prevent drifting snow from accumulating on the greenhouse roof.
– Pantry provides long-term food storage to reduce trips to the store.
– Storage room for greenhouse supplies and potting bench.
– Buried cisterns (not shown) with gravity flow design or back-up water hand pumps in case of blackouts.
– Joseph Jenkins sawdust composting toilets greatly reduce water use. Water conservation is important since water deliveries are expensive and unreliable in remote areas.
– Enhanced livability over current low income housing: traditional design for cultural acceptance; warmer (huge psychological boost when the floor and air temperature are always comfortable); more pleasant living environment with abundance of plants and much greater daylighting (combats cabin fever); fresh food production and higher oxygen level; superinsulated design with far lower energy costs (money stays in the community); adequate space for extended families and storage; greater self sufficiency.

http://www.naturalbuildingblog.com/solar-pit-house-building-details

The free PDF plan set is here:
http://5892-presscdn-26-36.pagely.netdna-cdn.com/wp-content/uploads/2012/05/Solar-Pit-House-PDF.pdf

Cutaway Drawings



Every house plan in my new House Plans book includes a full-page 3D cutaway drawing.

My new house plans book covers my most popular house designs. These houses are low-cost, DIY, sustainable house designs, many of which can be built for less than $10,000 if you use locally sourced materials such as earthbags, straw bales and recycled wood.

Each house plan includes a full-page 3D cutaway drawing (similar to the one above) that shows the home's interior and how it is built. This is one of the best features of the book, because it takes two dimensional drawings and turns them into colorful, realistic images that are much easier to visualize. If you order one of these plans from **Dream Green Homes.com** the full-sized cutaway drawing is included at no extra charge.

This new PDF ebook is now available online from a high speed download site for just $20.

This book was a two year, two thousand hour labor of love project, so the quality is high.

http://www.naturalbuildingblog.com/25-small-sustainable-house-plans-cutaway-drawings

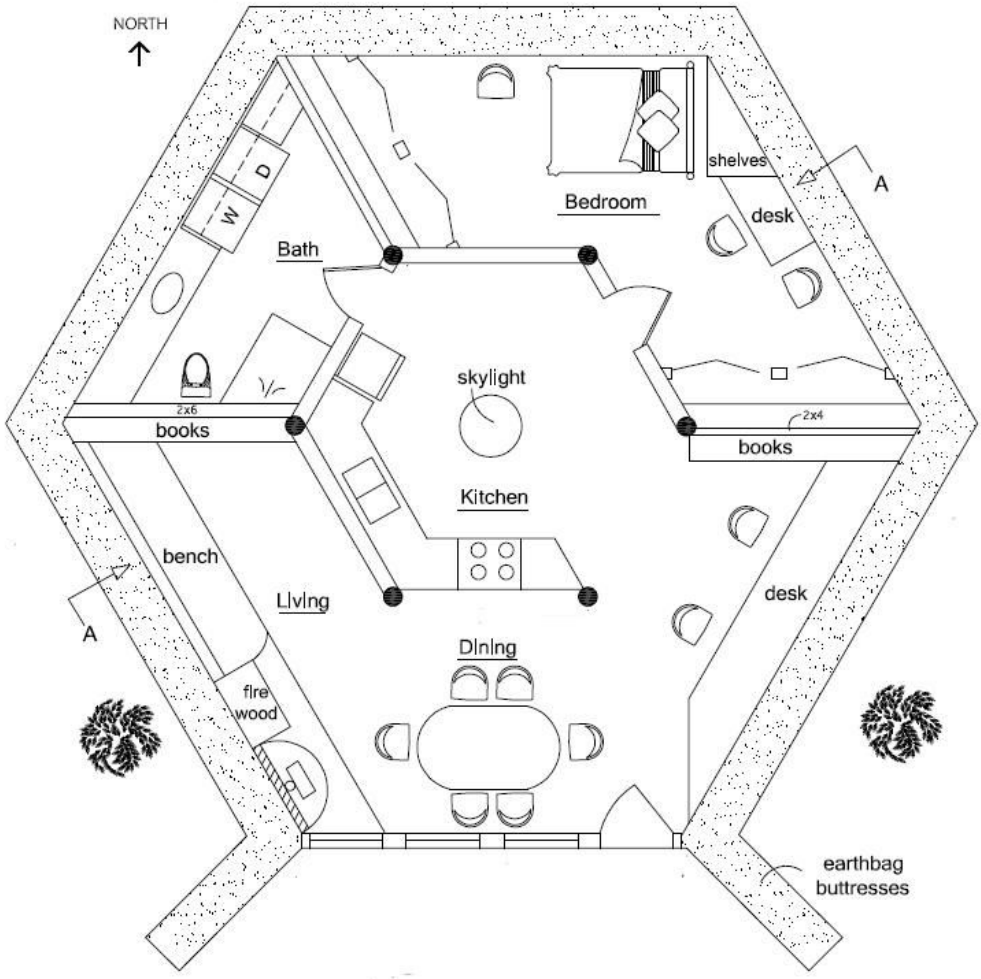
Hobbit House

South elevation of the Hobbit House

Many people dream of a simpler life, free of the cares of this world. They want a home that is easy to build and maintain, small yet adequate in size, with everything they need to live comfortably with their small friends. This one and a half story home is designed for those people. Features include drop-down stairs that lead to a spacious loft, wood stove heating, and modern kitchen with pantry space for Hobbit food. The undulating thatch roof or living roof is created by varying the knee wall height above the bond beam. 24-6″ diameter with 471 sq. ft. interior, 471 sq. ft. loft, total 942 sq. ft. interior, one bedroom, one bath; footprint: 27-6″ x 27-6″

Optional open-air second story deck
http://www.naturalbuildingblog.com/hobbit-house

Earthbag Lodge



Earthbag Lodge floorplan (lodges can be clustered to create unique home designs)

Specifications: 800 sq. ft. interior, 1 bedroom, 1 bath, Footprint: 40′ x 40′

Description: Based on ancient Native American designs, this earth lodge with living roof will keep you cozy and warm even in the harshest climates, because it is compact, earth-sheltered, insulated and uses wood heat. South-facing windows and skylight over the kitchen ensure ample daylighting. It can be built for about $2,000 assuming wood poles are gathered locally.

Building basics: This hexagonal structure consists of earthbag walls, about head high, and a wood framed wall on the south. Six large center poles with timber beams support sloping roof poles and living roof. To reduce risk of moisture problems, it's best to build above grade and add earth on top of the structure rather than digging below grade.

http://www.naturalbuildingblog.com/earth-lodge

Modular Pod House

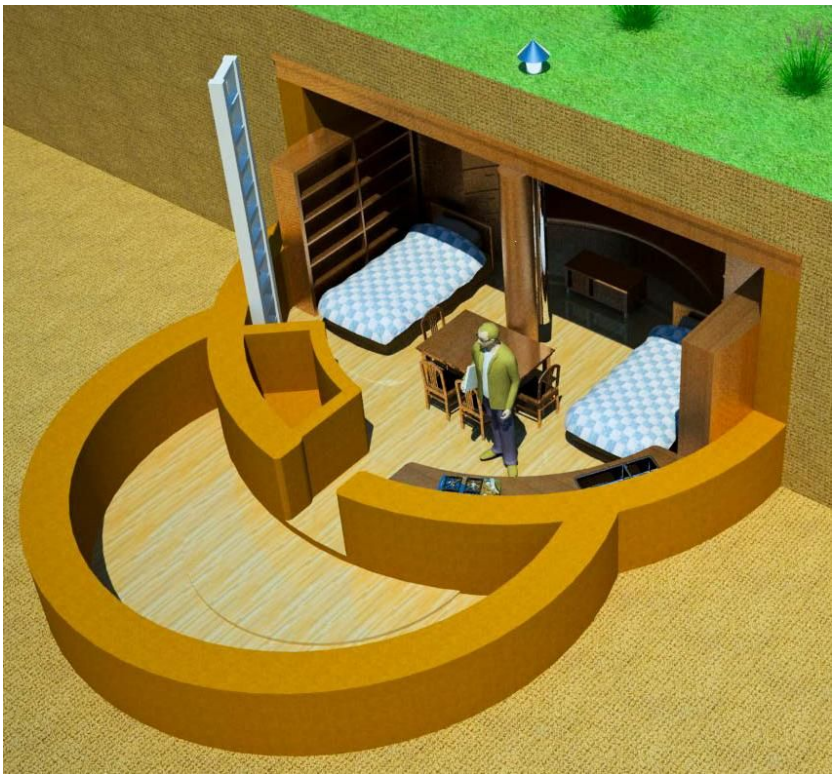
Modular Pod House south elevation

Specifications: Main pod = 372 sq. ft., double bedroom pod = 372 sq. ft., master bedroom pod = 372 sq. ft., connecting spaces = 220 sq. ft., total = 1,336 sq. ft. interior, Footprint: 42′ x 87′

Description: This design connects hexagonal pods or modules that can be arranged in various configurations using more or fewer pods. This enables the home to be built one stage at a time. The bonus room in the double bedroom pod can be used as a study, etc. The bonus room in the master bedroom pod can serve as a home office, guest room, etc.

http://www.naturalbuildingblog.com/modular-pods

Earthbag Survival Shelter



Earthbag Survival Shelter cutaway view

Specifications: 20′ DIA (314 sq. ft. interior plus pantry), Footprint: 23′ x 31′

Description: This round earthbag shelter for up to 4-5 individuals is designed for survival through disaster, plague, etc. It is low cost, durable and practical. This shelter is designed for DIYers on a tight budget who will do most everything by hand. Instructions include numerous key details not evident on the plan: venting, roof framing, how to reduce excavation by 50%, drainage, water supply, etc. I have not seen a better, more practical survival shelter plan.

The building details of this survival shelter were published in issue #3 of the Survivalist Magazine. http://www.naturalbuildingblog.com/how-to-build-a-survival-shelter

When I designed this survival shelter, I had four key concepts in mind: practicality, simplicity, safety and cost. Each concept is discussed in more detail below.

Practicality
Round structures enclose more space for a given amount of materials. There are no dead corners or wasted space. Round earthbag structures are the easiest shape to build. Poly tubes (the easiest and fastest method) or poly bags (lower cost if recycled and suitable for someone working alone) are easily shaped into curved or round shapes.

Simplicity
Another main advantage is simplicity of construction. What could be simpler than filling and stacking bags of earth? Almost everything you need to know is freely available on the Internet. The main skills can be learned in a few minutes simply by being shown or watching a video. My **Naturalhouse YouTube channel** shows all steps of construction. And most people already have the basic tools around the house – shovels, buckets, garden hose, ladder. The other few tools required can be easily made or purchased inexpensively.

Safety
Round structures are inherently stronger than rectilinear structures. This means the enormous forces of soil against walls below grade (many tons of pressure) will be transferred around the structure. This concept is often stated "round is sound."

http://www.naturalbuildingblog.com/earthbag-survival-shelter

Cool Pantries: Storing Food Without Using Power

Earthbag cool pantry for storing food without electricity

What's the difference between a cool pantry and root cellar? Humidity. Root cellars are very practical for storing certain types of produce, and have been a key part of sustainable households for centuries. Root cellars are kept fairly moist in order to best preserve the crops that are stored there. However, the high humidity limits their use since many food items require a dryer environment to avoid spoilage. A cool pantry with low humidity is suitable for storing a wider range of food items.

Kelly Hart and I created a simple, easy to build design to help make cool pantries a standard feature in homes. This design can be added to most new homes or retrofitted to existing houses. The idea of having a large cool storage room next to the kitchen makes so much sense to us that we think all houses should be designed this way. This facility uses no energy to keep things cool and promotes a lifestyle of fewer miles driven, along with a feeling of abundance and security. Imagine millions of homes with this feature and how much energy could be saved.

You can read the full article by buying the February/March 2011 issue of **The Owner Builder Magazine**. http://www.theownerbuilder.com.au

http://www.naturalbuildingblog.com/cool-pantries-storing-food-without-using-power

Reference

Natural Building Blog http://www.naturalbuildingblog.com
FAQs Most common questions answered here. http://www.naturalbuildingblog.com/faqs
Free Bulletin Board http://www.naturalbuildingblog.com/bulletin-board
Earthbag Videos – All of the best earthbag videos can be viewed for free on our main website at Earthbag Building.com that has everything about earthbag building http://www.earthbagbuilding.com/videos.htm
GreenHomeBuilding.com http://greenhomebuilding.com Kelly Hart's site is one of the largest, most popular websites on natural building and green building.
Earthbag House Plans – view all of my plans https://earthbagplans.wordpress.com Dream Green Homes – ordering page for my house plans http://www.dreamgreenhomes.com
Cover Photo - The Year of Mud